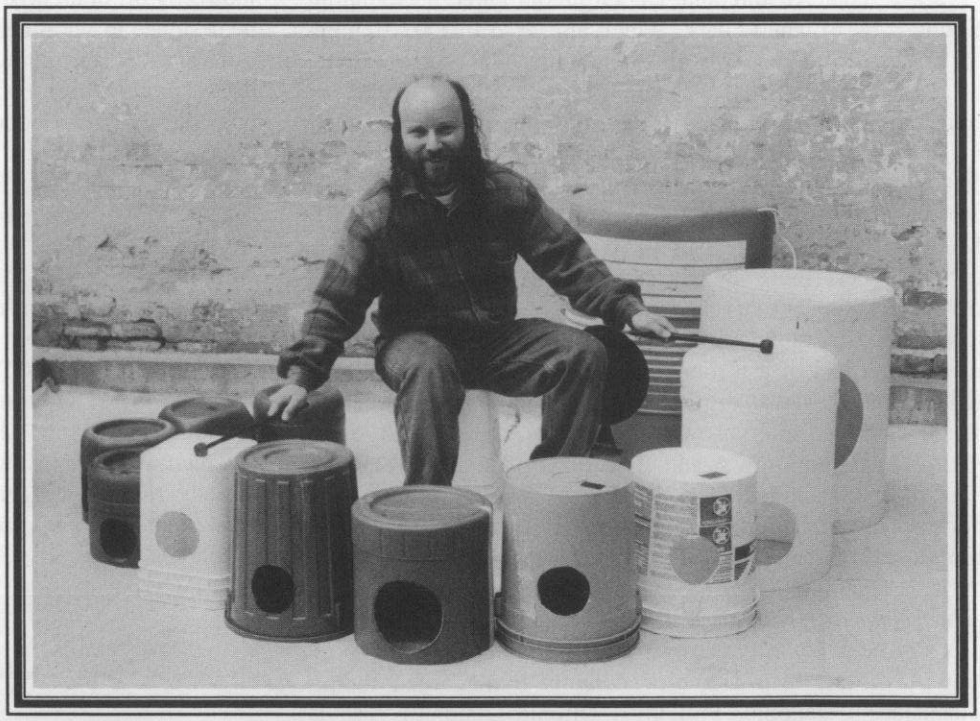
VOLUME 13 #3 MARCH 1998 PRICE $6

EXPERIMENTAL MUSICAL INSTRUMENTS

For the Design, Construction, and Enjoyment of Unusual Sound Sources

BIG AND LITTLE



Musical strings normally produce their sounds by transverse vibration — that is, by a side-to-side movement, which can easily be made to drive a soundboard and produce an audible sound. But other modes of vibration can occur in strings as well. One of them is the longitudinal mode, in which waves of compression reflect back and forth through the length of the string. Like transverse, longitudinal vibration can be used to drive a soundboard. But rare are musical strings designed to operate in this mode. Why? Because the frequency of longitudinal vibration for strings of reasonable length is so high that the resulting pitches turn out to be well above the musically useful ranges. To produce fundamental tones comparable to those of conventional instruments, you would need strings 40, 60, or 100 feet long. Who would ever build such an instrument?

Ellen Fullman would. You will find an article on her work in this issue of *Experimental Musical Instruments*.

Also in this issue we have a report from Michael Hearst on Hohner, the company primarily responsible for popularizing the harmonica — and, as well, for introducing the principle of the free reed into a century's worth of other improbable and inventive instrument forms. Ray Wilding-White, in another of this issue's articles, describes the Philips Pavilion of 1958, a building conceived as a musical instrument. We also have one article on drums made from plastic buckets, and another on string instruments made from pots and pans. We have a photo essay on sound sculptors in Hungary, and a look at how structureless form takes shape as a musical instrument ...

... And much more. So open, and read.

Photo above: Jody Kruskal with a tuned array of bucket drums. See the article starting on page 33.

I JUST WANTED TO SHARE with you a "found" instrument I've been enjoying lately. In the pavement of the busy road outside my window are drilled eight holes, each 3" diameter and from 10" to 24" deep. They are spaced about six feet apart, in more or less of a straight line, running about a foot away from the curb. When it rains, they fill with varying amounts of water, and the cars passing over them make randomized water-drum music. The sound is a lot like the cupped-hand-hitting-end-of-tube sound. It's quite pleasant, especially when there's lots of traffic and the weather is bad!

— Cyrus Heiduska

I ENJOYED MITCHELL CLARK'S ARTICLE "Sounding Antiquity," as I have Atrium and De Organographia. ["Sounding Antiquity," by Mitchell Clark, which appeared in *EMI* Volume 13 #2, December 1997, was an extended review of several CD and LP releases of music of ancient Greece.] For the sake of completeness, I thought I should mention another recording of some of the fragments of ancient Greek music, the Musurgia Records Theory Series A. No. 1, *The Theory of Classical Greek Music*, by Fritz Kuttner, J. Murray Barbour, and Roy T. Will, 2nd revised edition, 1962. This LP record was boxed with a 34-page booklet describing ancient Greek and early medieval tuning theory.

The musical examples were played on a small harpsichord tuned with the aid of a Stroboconn to ± 1 cent. While the LP contains some medieval examples in Pythagorean tuning and a number of isolated intervals and tetrachords, the *Seikilos Song*, *Hymn to Helios*, and the A and B sections of the *First Delphic Hymn* are also included. The *Skolion of Seikilos* ("Song") is performed in two tunings, the Diatonic homalon (misnamed hemiolion here) with intervals of 12/11 x 11/10 x 10/9 and Archytas's Diatonic, 28/27 x 8/7 x 9/8 (both ascending).

The *Hymn to Helios* uses the Soft Diatonic of Aristoxenos (20/19 x 38/35 x 7/6 in Ptolemaic ratios ascending). The diatonic section A of the *First Delphic Hymn* is Pythagorean tuning (Eratosthenes's Diatonic, Ptolemy's Ditonic Diatonic). The B section is written in the Greek Chromatic genus and two such genera are used on the record. The first performance uses Aristoxenos's Tonic Chromatic, 20/19 x 19/18 x 6/5 according to Ptolemy, and the second , Aristoxenos's Soft Chromatic, 30/29 x 29/28 x 56/45 in Ptolemy's string lengths.

There are certain obvious problems with this production. In addition to employing an anachronistic instrument for the musical examples, the booklet repeats a number of minor errors made in Barbour's book *Tuning and Temperament*, in regard to the the names of the genera and their inventors. It also fails to point out that Ptolemy's interpretation of Aristoxenos's "parts" as string lengths is a gross distortion of the intervals of Aristoxenos's tunings as well as his intent. Too much time is spent on the rather irrelevant medieval pieces as well as on isolated intervals, though a better case can be made for the latter. However it was a valuable teaching resource at its time and it is a pity that only the first three of the projected series of eight releases seem to have appeared. One particularly misses the last one on quarter-tone and other modern scales.

—John Chalmers

I JUST RE-READ the Sirens article (part II) in September's *EMI*, and I had a thought or two about sirens:

What about a foot-powered siren based on the weaver's spinning wheel and the pump organ? Foot pedals spin the large (2 or 3 foot) disc; they also pump air (or vacuum) for the voice. The large wheel, perhaps with a heavy rim, has enough momentum to keep a relatively constant speed once you get it going and get your feet into a rhythm.

But even better would be if the air/vacuum pump is run indirectly off of the wheel, because then the pump could probably be designed to act as a speed governor, like the spinning vanes in a music box. Once you get the wheel going to a certain speed, the air pump's back-resistance will tend to reinforce a particular pedaling rhythm. I hope. I have an exercise bike which has big fan blades built into its wheel, so the resistance builds up as you gain speed. Same idea. It doesn't really feel like it has a preferred speed, though, so maybe this wouldn't be all that helpful.

It occurred to me that a CD player or CD-ROM drive is almost an optical siren. CD-ROM mechanisms are always showing up in surplus catalogs for less than 10 dollars; I wonder how hard it would be to silk-screen (or hand-paint) a pattern on a CD-sized disc and wire up the CD mechanism to play it?

Or, using a CD-writer, you could record twenty-one thousand (72 minutes * 300 RPM = 21600) different dot-tracks on a CD, and then, with your subverted surplus player, just play them back directly as analog signals instead of doing any kind of digital conversion — it's still an optical siren! But that's probably going too far.

— Ranjit Bhatnagan

NOTES FROM HERE AND THERE

A WIND-CHIMES TUNING PROGRAM FOR PC

Greg Phillips has created a computer program to assist in making wind chimes. *Chimes*, as the program is called, allows the user to simulate and experiment with different chime tunings by specifying them and then hearing them played back on the computer. The tunings can be specified by frequency, and so can make use of just intonation, equal temperament, or any other tuning-logic you might choose. The program then allows you to calculate tube lengths for each chime pitch, based on the length and pitch of a sample tube. Finally, Chimes provides audible reference tones for fine-tuning to the chosen set of pitches. In addition, the help screen provides step-by-step instructions for the entire chime-making process in clear and practical language.

The program is written for Windows, and you'll get the most out of it with a Soundblaster-compatable sound card. (Without the sound card you can still hear the tones played back through the computer's internal speaker, but you sacrifice the ability to hear all the tones of any chosen tuning simultaneously.)

The program is available and downloadable online from ftp://ftp.maths.bath.ac.uk/pub/dream/xen/chime.zip

You can reach the programmer Greg Phillips by email at gphillip@senet.com.au

---

THE SOUND OF THE PARASAUROLOPHUS

The parasaurolophus was an herbivorous, duck-billed dinosaur weighing two to three tons which lived during the late cretaceous period, seventy million years ago. Extending backwards from the top of its head was a bony crest about three feet long, containing a network of hollow tubes connected to the breathing passages. A pair of scientists at Sandia National Research Lab and the New Mexico Museum of Natural History in Albuquerque have been exploring the possibility that the hollow crest functioned as a trumpet to produce distinctive calls. Working from sophisticated, 3-D X-ray images of the crest of a well-preserved parasaurolophus found in New Mexico in 1995, Dr. Carl Diegert and Dr. Tom Williamson have made a computer simulation of what the sound may have been like, based on the resonances of the tubes. Their work follows on that of David Weishampel of Johns Hopkins University, who has created plastic models of parasaurolophus crests in order to experiment with them acoustically. This story comes from the web pages of the New Mexico Museum of Natural History and Science at http://nmmnh-abq.mus.nm.us/nmmnh/nmmnh.html (thanks to Ray Brunelle for the pointer). The web pages don't address the question of how the scientists modeled the portion of the dinosaur's vocalizing apparatus by which the original vibration might have been generated.

WEB SITES OF INTEREST

The following is a short list of sites on the World Wide Web relating to unusual instruments that have come to *EMI*'s attention lately. Many more are listed in previous issues of *EMI*. For a more inclusive listing of web sites relating to musical instruments, try http://capella.dur.ac.uk/doug/instruments.html. This site even includes a list of links to other lists pertaining to instruments.

"Some Basics on Shell Trumpet," the web version of Mitchell Clark's article which appeared in *EMI* Vol 12 #1: http://www.furious.com/perfect/shells.html

Harmony Hollow's bronze bells and chimes: www.harmonyhollow.com

Cool & Strange Music Magazine: http://members.aol.com/coolstrge/coolpage.html

Pictures of several unusual instruments from Mark Poss: www.cyberhighway.net/~mposs1/paindx.html

Dandemutande (publication devoted to mbira and marimba): www.rootsworld.com/rw/dandemutande

Software created by Greg Phillips for making and tuning wind chimes is downloadable from ftp://ftp.maths.bath.ac.uk/pub/dream/xen/chime.zip

Information on tabla, from David Courtney: http://www.tablasite.pair.com

Sound sculptures from Jan Cardell: http://www.algonet.se/~jancard

---

IN THIS ISSUE

EXPERIMENTAL MUSICAL INSTRUMENTS
For the Design, Construction and Enjoyment of Unusual Musical Sound Sources

ISSN 0883-0754. Printed in the United States

EDITOR: Bart Hopkin OFFICE MANAGER: Karen Jaenke

PROOFREADER: Janet Hopkin

EDITORIAL BOARD: Donald Hall, Roger Hoffmann, Jon Scoville, Robin Goodfellow

Published in March, June, September and December by Experimental Musical Instruments, P.O. Box 784, Nicasio, CA 94946. Phone / fax (415) 662-2182.
E-mail EMI@windworld.com Web Site http://www.windworld.com/emi

Subscriptions US$24/year ($27 in Mexico and Canada; $34 overseas). Back issues & cassettes available; write for prices or see ads in this issue.

ADVERTISING POLICY: Experimental Musical Instruments will run ads which are potentially interesting or valuable to the readership. Please write for advertising rates. Subscribers can place "classified" ads of up to 40 words without charge.

SUBMISSIONS: Experimental Musical Instruments welcomes submissions of articles relating to new or unusual musical instruments. A query letter or phone call is suggested before sending articles.

THE ERIE ART MUSEUM in Erie, Pennsylvania, is currently exhibiting resonator guitars created by John and Rudy Dopyera, as well as other contemporary and historical makers. Resonator guitars, AKA dobros, have within the body the unique aluminum-cone sound-radiating system created by the Dopyera Brothers in the 1920s. As you can see from the photo, they're often rather extraordinary looking from the outside as well. The Erie Art Museum exhibit, titled *Loud and Clear*, is scheduled to run through April 15, 1998. For information, phone (814) 459-5477; email erieartm@erie.net; world wide web: http://www.erie.net/~erieartm/

National Hawaiian Style 2 squareneck Tricone resonator guitar, 1928.
Photo by Bob Lowry, Lowry Photography, Erie, PA

COMMUNICATING WITH *EXPERIMENTAL MUSICAL INSTRUMENTS*

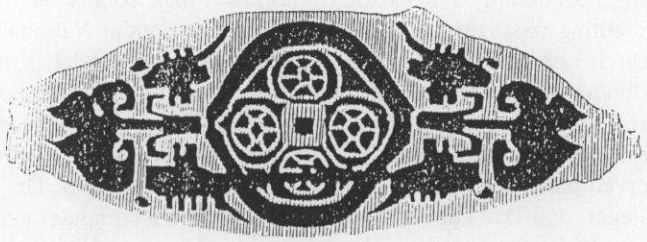
POST: PO Box 784, Nicasio, CA 94946, USA

PHONE/FAX: (415) 662-2182

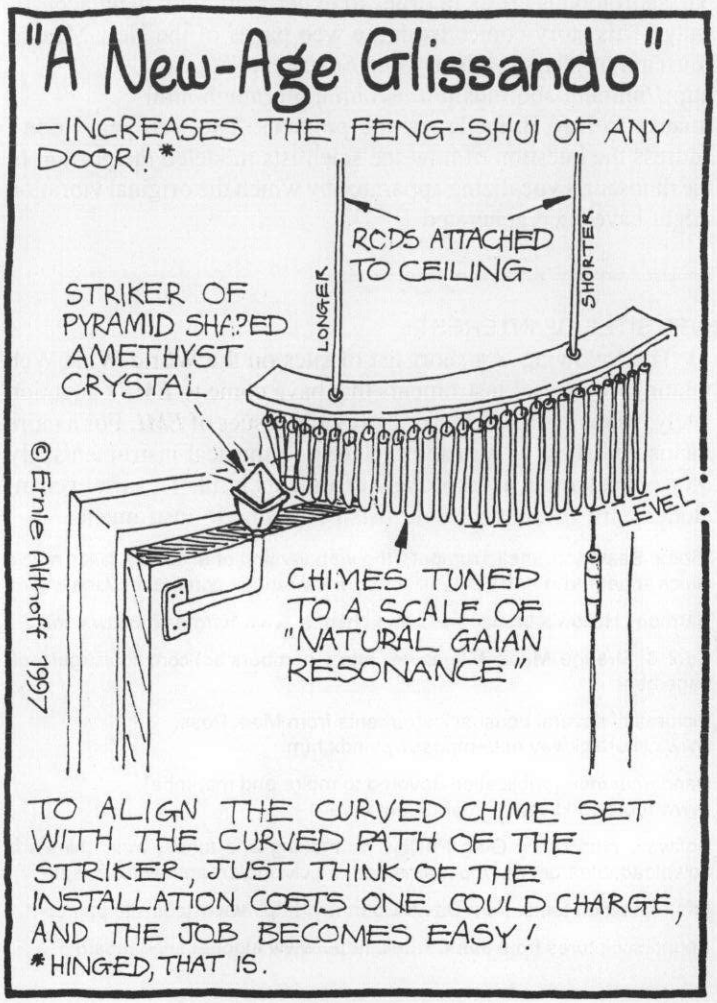
EMAIL: EMI@windworld.com

WEB SITE: http://www.windworld.com/emi

For information on subscriptions, books, and other items we have available, see our ads near the end of the Notices section and elsewhere in this issue, or contact us.



Below: Another in a series of possible instruments conceived and drawn by Ernie Althoff



THEY'RE STILL MAKING ORCHESTRIONS

The front cover of a recent catalog from the Hammacher Schlemmer mail-order company [(800) 543-3366] features a big picture of a beautiful, new, oaken orchestrion. Notice the word "new" in the preceding; the instrument is not an antique. The Ragtime Band Organ (as it's identified in the catalog) is made by a contemporary manufacturer in the style of the wonderfully elaborate mechanical instruments of the late 19th and early 20th centuries. It features bass and snare drums, cymbal, tambourine, triangle, castanets, glockenspiel, and a calliope of 43 pipes, all operated pneumatically by means of punched paper roles. The casing, highly ornate and provided with lots of glass so you can see the mechanisms at work, is over seven feet high and three and a half feet wide. The price is a mere $11,500 plus another $250 s&h. — OK, that's a bit of a shock, but probably not out of line when you consider what must go into making such a thing. In the tradition of catalog merchants not wishing to redirect business away from themselves, the instrument's manufacturer goes unnamed.

FIVE MORE ISSUES TO GO

As we announced in the last issue of *Experimental Musical Instruments*, we will cease publishing the magazine after our June 1999 issue. *EMI* will not disappear entirely following that; we will continue to operate as an outlet for the books, tapes and back issues that we will have produced over the magazine's 14-year life span. And for the meantime we have lots of good stuff lined up to appear in the remaining issues, so please do stick around.

CORRECTIONS

A correction and an added bibliographic note, courtesy of Mitchell Clark, for K.U. Wahl's article "Chinese Wind-Driven Kites" appearing in *EMI* Volume 13 #1 (September 1997): The reference in the article's first paragraph to the "fifth dynasty (970-960 AD)" should refer to the period of Chinese history known as the Five Dynasties, lasting from AD 907-960. The book by Wang Hongxun that appears in the bibliography in its German translation *Die Kunst des Drachenbaus* has also appeared in English under the title *Chinese Kites*, published by the Foreign Language Press in Beijing in 1989 in their "Traditional Chinese Arts & Culture" series.

In Ángel Sampedro del Río's ad in last issue's notices section requesting information on bamboo saxophones, we printed an incorrect fax number. The correct fax is: [international code, plus] (541) 794-3880. Apologies to Ángel and to anyone who may have tried unsuccessfully to make contact — please try again with the corrected number.

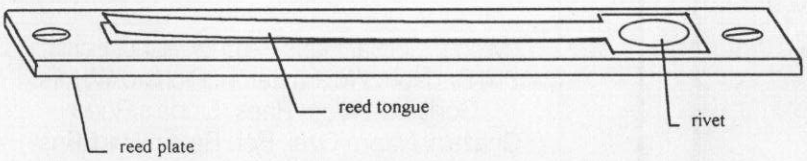
THE FREE REED

by Michael Hearst

Matthias Hohner, 1803 - 1902

Harmonicas, accordions, bandoneons, harmoniums, concertinas, melodicas, Claviolas and Pianets all share something in common besides being considered some of the most exasperating instruments by many people) ...the free reed. Of course there are many more instruments that fit into this free reed category, but let's start there. What is a free reed, where did it come from and how does it work?

Your first thought might have been that a free reed is one that you just blew out of your harmonica, or one that's on the lam from Alcatraz. In reality, a free reed is a reed which is only connected at one end and is left to flutter or vibrate in and out of the reed plate at the other. The reed usually lies within a tight frame (or reed plate) that blocks air flow. The reed's freedom of movement creates a pitch without relying on pipe lengths. This differentiates this type of instrument from those which feature a beating reed, found in most woodwinds like clarinets and oboes as well as many church organs. The beating reed relies on the length of a pipe for its pitch. In free reed instruments, generally only one pitch is created by each reed. In the case of the harmonica, a different reed is used for blown air than for drawn air.



Making a free reed work properly can prove to be quite an arduous task. Like many musical instruments, getting a good sound depends on many factors. Within the reed work itself, materials, tuning, distance and spacing of the reed tongue are all essential. The easiest way to learn this would be to open up an old harmonica and examine it closely. Generally the reed should be on the side of the reed plate receiving the flow of air. In its rest position, the reed should be close enough to the plate to block most of the air flow, but still opened slightly to allow the initial attack of air to start vibrating the reed. A slight curve in the reed concave to the plate (see the picture above) is common practice because the tip is then raised to better initiate vibration, while the back can remain airtight.

Length and weight of the reed will determine the pitch. The longer and heavier the reed, the lower the pitch. A shorter and lighter reed makes the pitch higher. Fine tuning can be achieved by filing away the reed at either the base or the tip. Filing the tip lessens the end weight and makes the pitch go up. Filing the base will make the reed more flexible and drop the pitch down. Minute changes in the reed's resting position will have dramatic effects on its tonal quality.

Of course the real trick in this situation is finding the right material for the reed. Although some free reeds are made of plastic or wood, the easiest material to work with is metal. The metal must be thin enough to vibrate easily but sturdy enough to resist corrosion and not to break the first time in use. It must also be able to resist failure due to fatigue, a common problem with all reeds. A good metal for this is hard to find and probably will require some experimenting. Although the earliest harmonica reeds were made of brass, alloys have proved to better withstand modern playing techniques. Incidentally, asking Hohner won't work; they guard their secret reed metal recipe as if it were the "Special Sauce" at Burger King. Like the first harmonicas made, the metal reeds can be hand hammered. Again, learning how to make a working reed will take lots of fortitude and experimentation. Throughout history, many cultures have accomplished this with great success. Examining their renditions will give us both inspiration and blueprints for our own designs.

Many sources point to the Chinese *sheng* as the first free reed instrument. Its invention is traditionally credited to the legendary Chinese empress Nüwa (circa 3000 BC). This hand-held instrument, played by blowing into a mouthpiece, has a set of lightweight, narrow upright pipes arranged over the central air chamber. With a free reed at the base of each pipe and a fingerhole a bit higher up, the player controls the instrument by covering and uncovering the fingerholes. The reed of a given pipe sounds only when its hole is covered, because the open hole disrupts the acoustic cooperation between reed and pipe without which the reed won't sound. While the *sheng* came into its own, spread widely and evolved into many variations, it wasn't until the 19th century that the harmonica as a free reed instrument would become one of the world's most widely used musical instruments.

Working for Hohner as a "harmonica technician" (yes, that was my actual job title) for the past two years, I heard many stories about the origin of this dandy little instrument. I've compiled what I believe to be the most likely scenario. This story takes place in the year of 1821, when a sixteen-year-old Austrian clockmaker by the name of Christian Friedrich Ludwig Buschmann felt the everyday tedium of his job. He turned away from the project he'd been working on and picked up several pitch pipes from his desk. We may never know if it was a stroke of brilliance, a fit of silliness, or one of those impulsive, spontaneous actions that have historically marked true creative invention that made him put them to his mouth in one big handful and blow through all of them together. To his delight the sound was harmonious and he realized that he had discovered a unique new instrument.

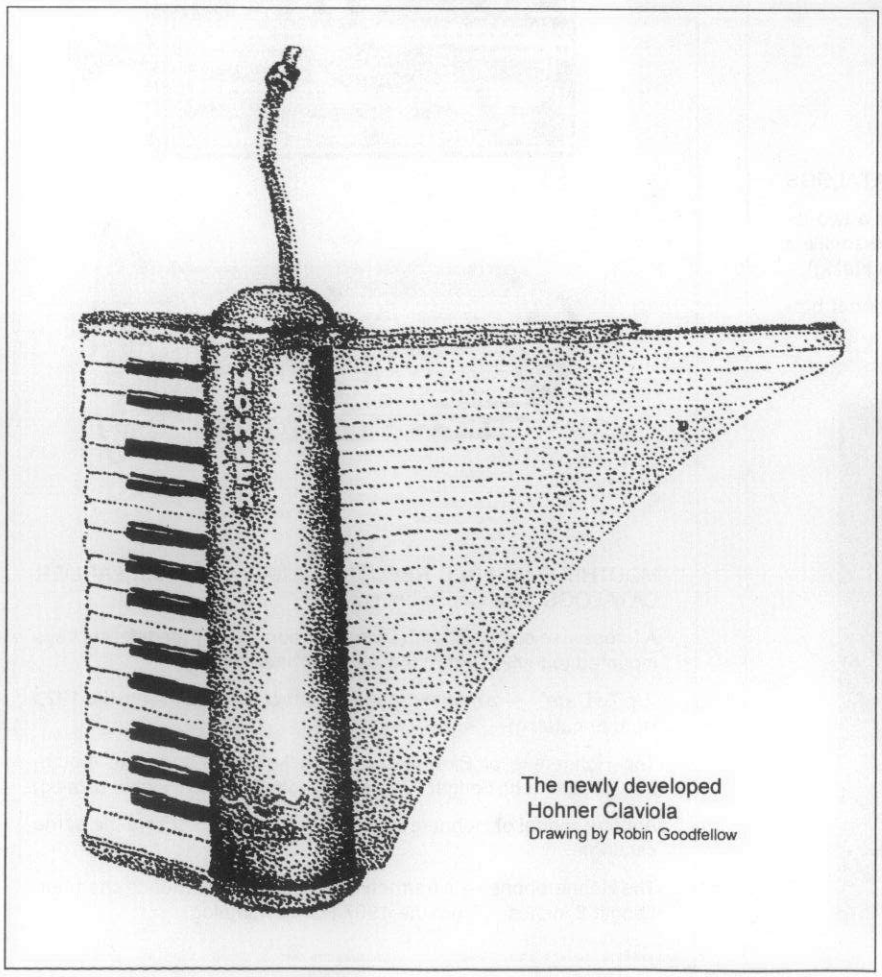
As a clockmaker of this time period, one also had to be a traveling salesman. Buschmann would often run into other clockmakers, to whom he would show off his new invention. Eventually, one got into the hands of Matthias Hohner, another clockmaker from the small southern German town of Trossingen. Hohner saw the possibilities of this musical device and quickly began to set up assembly. It is rumored that of the first few harmonicas produced, the defective ones were shipped to relatives in Canada. Nonetheless, it caught on in the western world, making the United States the number one market for this inexpensive new instrument. Sales increased at an exponential rate, and today Hohner sells over 650,000 diatonic harmonicas annually.

Hohner has more or less monopolized the free reed market over lesser known companies such as Lee Oskar, Huang, Farfisa, Magnus, Paolo Soprani, Titano, and Castiglioni. By producing a wide range of free reed instruments such as accordions, concertinas, pianets, melodicas, over 50 models of harmonicas, and even (my favorite) the recently released Claviola, Hohner has been able to keep up with the demand for new and better free reed instruments.

OK, I'll tell you about the Claviola now. Remember the scene in *Star Wars* at the cantina where the band members are all playing bizarre space-age instruments that seem to wrap around their bodies in exotic fashions? That's the easiest way to describe the Claviola's sound and especially appearance. The Claviola was invented over 30 years ago by Ernst Zacharias, who also invented the Pianet and Clavinet. Some say it took him this long to pull the wool over Hohner's eyes to put it on the market in 1996. The Claviola, like a melodica, accordion, and clarinet combined, works by blowing into a pipe which in turn fills an air chamber. When a piano key is pressed, air flows to the corresponding reed. Its design is similar to the construction of the melodica; however, the catch is in the reed layout and pipe chambers. These together create a tone not unlike a Mellotron (remember "Strawberry Fields" by the Beatles). The reeds are set to vibrate backwards. As I mentioned earlier concerning the placement of the reed on the reed plate, on the Claviola the air comes from the opposite side. This forces the reed to be "overblown," a technique which is often used by harmonica players to achieve pitches that are not normally on a standard diatonic harmonica. This creates a different and unique tone quality which is only then shaped by the length of the pipes. Because of this design, it becomes rather easy to make nontraditional sounds out of this nontraditional-sounding instrument. What I mean is, you can make this odd-sounding instrument sound even odder by inhaling instead of exhaling (making the reeds move in a normal free reed pattern), as well as bending pitches by moving your hand across the pipe ends (changing the pipe lengths and lowering the pitch).

Although you won't find them in too many local music stores, you can purchase one by calling Hohner.

I'm sure you probably are now enlightened to put this magazine down and run out to your hardware store and become the next Ernst Zacharias. Anyway, I wish you luck in your endeavors and I hope all this reading will help you with your reeding. (Yes, that was a bad pun, but how else do you end an article on free reeds?)



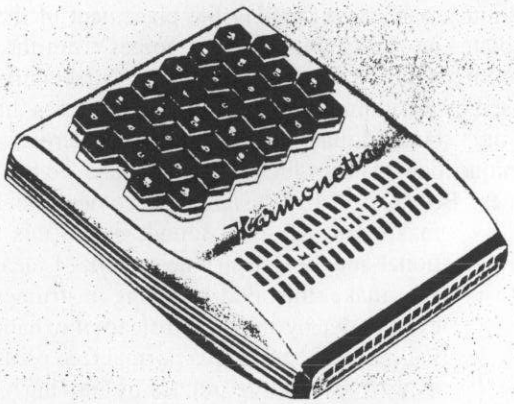
The newly developed Hohner Claviola
Drawing by Robin Goodfellow

Mike Hearst worked, until recently, as a harmonica technician at the Hohner Company plant in Ashland, Virginia. He is proprietor of Urban Geek Studios in Richmond, Virginia. He collects and plays a wide variety of free reed instruments, not to mention many other unusual instruments, and is often known to play klesmer Christmas carols on the Hohner claviola.

On the following pages:
Historical Hohner →

IN HONOR OF HOHNER

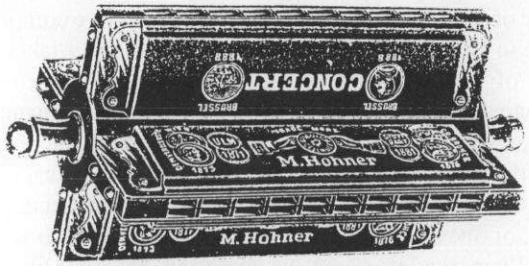
Since its founding in 1857, the Hohner company has developed hundreds of musical instruments for mass production, almost all of them employing free reeds. In addition to their hugely successful harmonicas and accordions in countless variations, these have included many unusual and less well known instrument types. On these two pages you can see a number of specimens, which Mike Hearst has gathered from Hohner catalogs and promotional materials dating back to the start of the century.

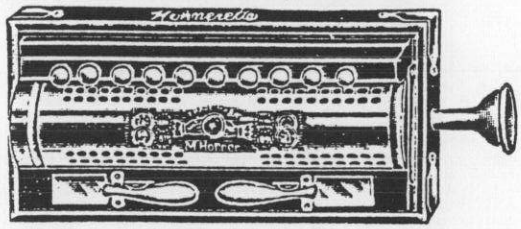


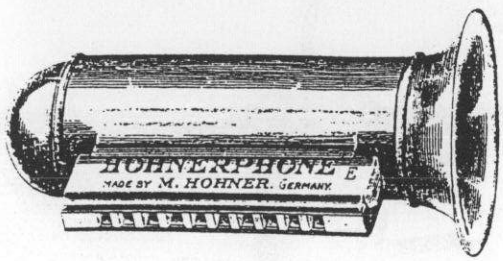
TWO INSTRUMENTS FROM RELATIVELY RECENT CATALOGS

Above: Hohner Harmonetta, a keyboard harmonica with a two-dimensional array of hexagonal keys. Size 7" x 6" x 2"; "the smallest polyphonic musical instrument." (From a 1970s Hohner catalog)

Below: The Hohner Melodica. (From a Hohner promotional brochure of the 1960s)







MOUTHBLOWN FREE REED INSTRUMENTS FROM EARLIER CATALOGS. From top to bottom:

A "crosswise combination," being harmonicas in four different keys mounted together. (From the 1923 Hohner catalog)

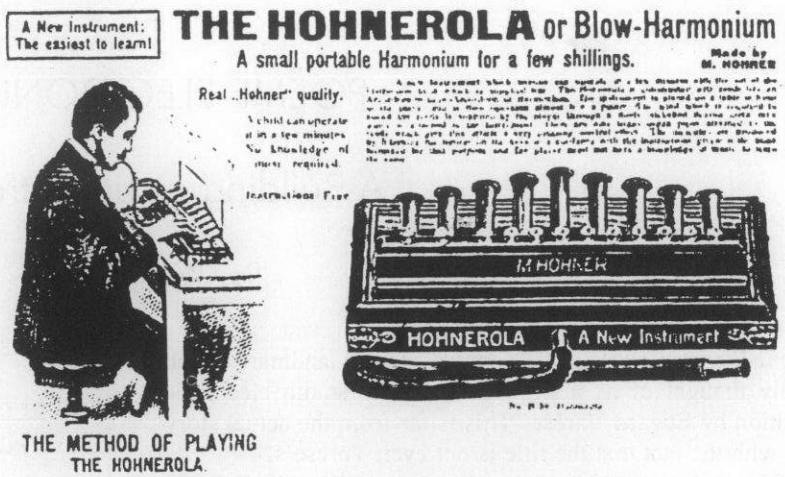
"Up To Date" — a mouth organ with attached bells. (From the 1923 Hohner catalog)

The Hohnerette or Blow-Accordion, a keyboard-operated, mouth-blown instrument. Length 10 inches. (From the 1907 Hohner catalog)

Another model of Hohnerette or Blow-Accordion. (From the same catalog)

The Hohnerphone — a harmonica with added resonance chamber. Length 8 inches. (From the 1907 Hohner catalog)

Point-of-sale promotion for retailers, shown in the 1907 Hohner catalog.



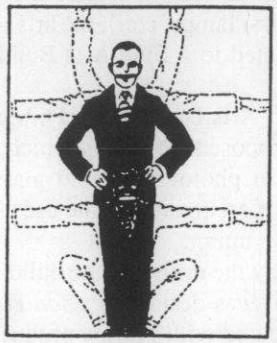
Another variation on the Hohnerola, or Blow-Harmonium.
(From the book *Hundert Jahre Hohner,* prepared for Hohner's 100th anniversary)

Harmonica playing suggestions from an unknown source (probably not put out by the Hohner company). Don't be fooled: the playing-through-the-ear technique is a trick invloving a miniature harmonica held in the left hand.

AN AMUSING NOVELTY EFFECT!

Play Harmonica Through a Hose

ANOTHER NOVELTY EFFECT



Use any single reed Harmonica.

Practice holding the Harmonica in your mouth for short intervals without the aid of your hands.

Next try arm movements, sideward, upward and forward while playing, bringing the hands back to the Harmonica in rhythm.

Next practice bending the trunk forward, holding the Harmonica in your mouth without the aid of your hands, and playing as you bend.

By combining marching, marking time, free exercises of arms and legs, trunk bending, etc., with Harmonica playing, a very interesting effect can be produced.

HOW TO SECURE A BEAUTIFUL TONE

Study the illustration carefully. Place a glass tumbler over the right end of the Harmonica and against the cheek. By moving the glass in a very slow shaking movement the tone is enhanced to a great degree.

HOW TO PLAY HARMONICA THROUGH YOUR EAR

HOW TO PLAY WHILE DANCING

With adhesive and some ordinary elastic, make a Harmonica holder which will slip over your head and hold your instrument fairly well in place.

With this device, two people can execute any kind of partner dance, folk dance, reel or jig, playing their own accompaniment as they do so.

The use of castanets adds greatly to a dance performed by a Harmonica player.

POÈME ÉLECTRONIQUE

A Building as an Instrument

Ray Wilding-White

Poème Électronique is a 20th century musical landmark which is usually thought of as a two-track, classic studio electronic composition by Edgard Varèse. This is far from the actual story starting with the fact that the title is not even Varèse's.

In 1958, Brussels, Belgium played host to a World's Fair. At the time the Dutch giant Philips Industries, now Philips-Magnavox, was a leader in lighting technology, electronics, electro-acoustics (the emerging field of hi-fi audio), automatic controls (these were the early days of the big mainframe computers), and was also releasing LP recordings under its own name.

The first World's Fair, spearheaded by Queen Victoria's consort Albert, was held in the specially built Crystal Palace in 1851 with the intent of promoting the products of manufacturers as well as growers, regions, and so on. Thus the Palace was cluttered with locomotives, ship models, farm machine, and numberless glass cases full of gizmos. This "strut-your-stuff" format became the standard for all the fairs held thereafter. Unless they were utilitarian (plates, chairs, lamps, etc.), the arts – usually very conventional – were relegated to a Fine Arts Building and music to a Concert Hall.

In a bold stroke, L. C. Kalff, Arts Director for Philips, broke with this boring tradition and proposed a building which, instead of showing off their products in photographs and glass cases, would itself be a demonstration of art created by the use of Philips products, a total techno-aesthetic union.

This would be realized both by the design of the building itself and by the function for which it was designed, a *son et lumière* show to be presented in it, executed with Philips products. (*Son et lumière*, sound and light, is the French term for what we call a "light show"; the medium predates American rock light shows by many years.)

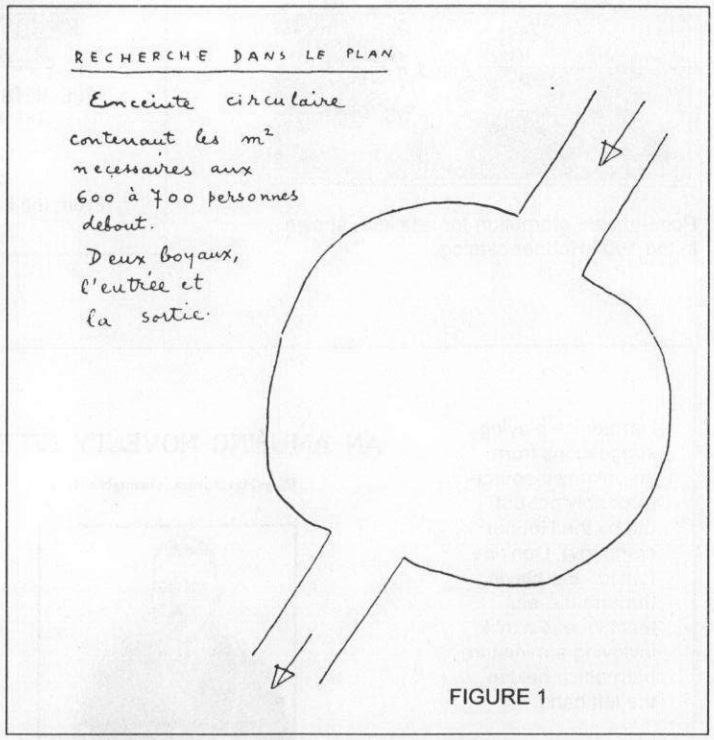


FIGURE 1

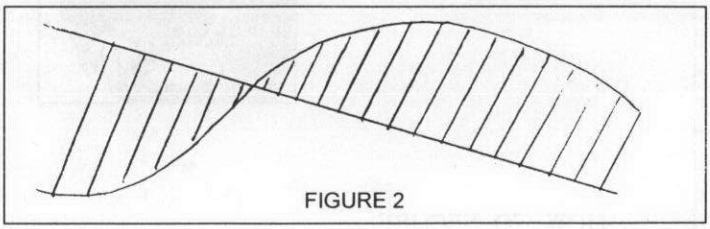


FIGURE 2

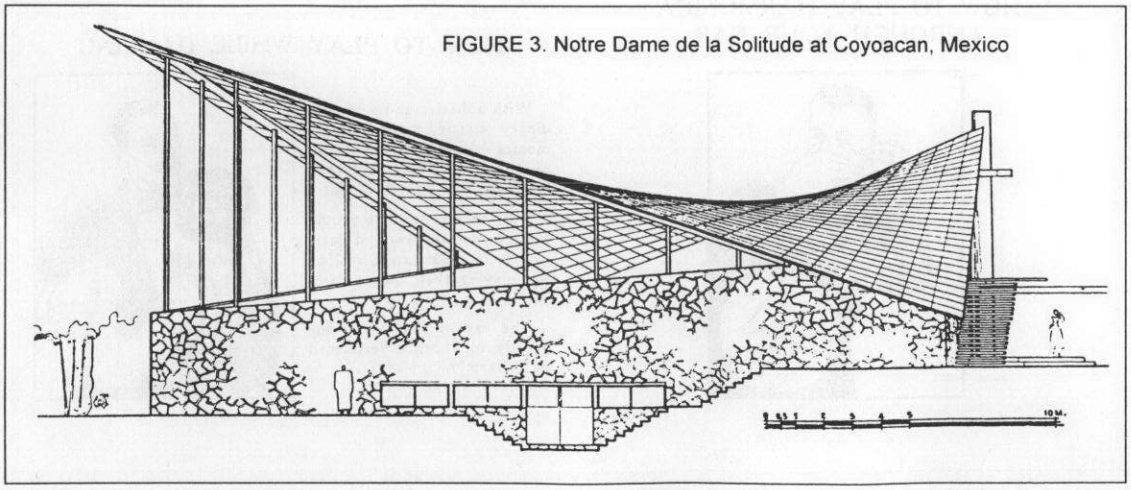


FIGURE 3. Notre Dame de la Solitude at Coyoacan, Mexico

The illustrations in this article are from *Philips Technical Review* Volume 20 No. 1, 1958/59 and *Philips Technical Review* Volume 20 No 2/3, 1958/59. *Philips Technical Review* is a publication of Philips Electronics N.V., Eindhoven, The Netherlands, of which Philips Magnavox in the USA is a subsidiary. Illustrations used here by permission.

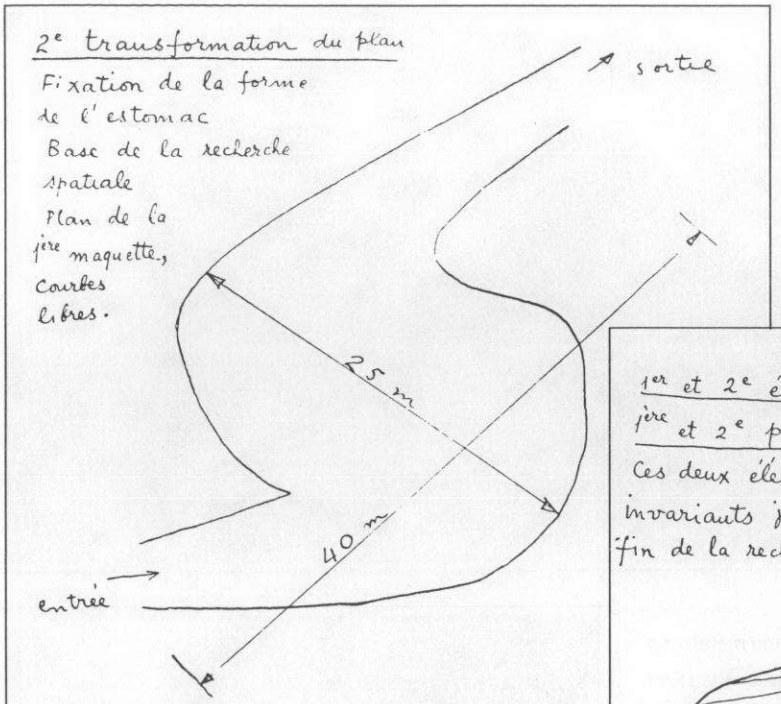


FIGURE 4: Development of the simple entrance / round space / exit design of Fig. 1 into what Le Corbusier aptly called "The Stomach."

Xenakis emerged as a composer after this fair and anyone familiar with his scores can see the origin of his ideas in his architectural drawings.*

Le Corbusier conceived of a more or less round space where six to seven hundred people could freely circulate with an entrance and exit (Fig. 1) and he gave this project the name *Poème Électronique*.

In order to ensure interesting distortions of the projected visuals, all the walls had to be curved both horizontally and vertically and, to avoid standing waves, there could be no parallel surfaces. Obviously, orthodox models for performance spaces were out.

Thus Xenakis suggested the idea of basing the shape of the building on mathematical surfaces, notably the conoid and the hyperbolic paraboloid (or "hypar" for short). Both are based on the general idea of having a series of parallel lines with one end on a straight line and the other on some arbitrary curve (Fig. 2). Such "ruled surfaces," as they are called, fulfilled the curved, non-parallel wall requirements. Further, it turns out that they are highly stable surfaces that could be executed in pre-stressed concrete, resulting in a very strong structure. There was a precedent in Felix Candela's church of Notre Dame de la Solitude, Coyacama, Mexico (Fig. 3). There have been any number of descendants, including Saarinen's TWA building at Kennedy Airport. Finally, all of the very hairy mathematics could be worked out on Philips calculators, thus fulfilling Kalff's almost Gothic concept of a building as an aesthetic-mathematical-symbolic-corporate totality (readers are referred to studies of Chartres Cathedral).

The drawings by Xenakis and the photos on these two

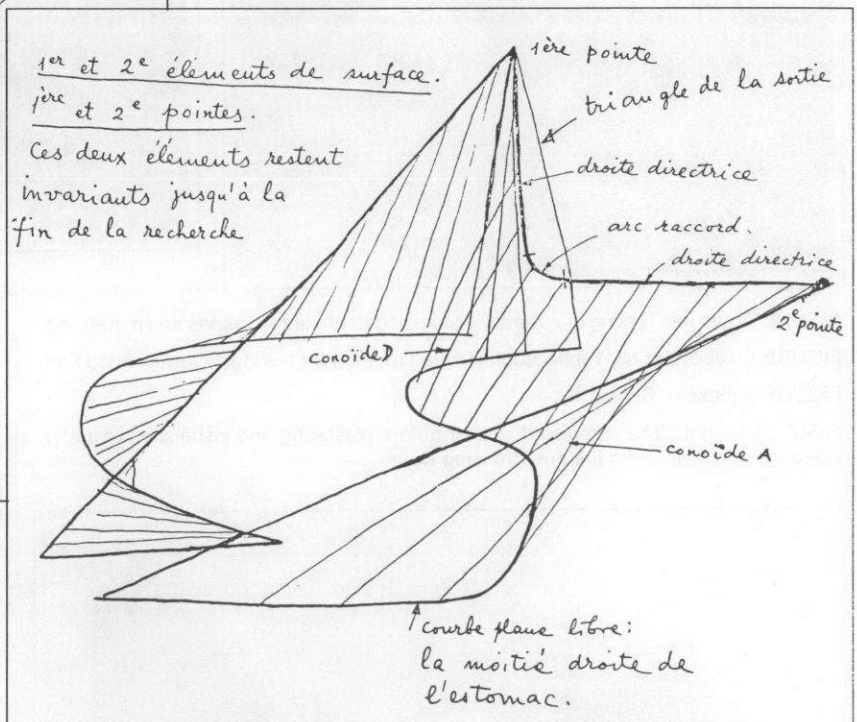


FIGURE 5: Conoids using the two curves of "The Stomach" and two straight lines. For technical reasons the conoids were later replaced with hypars.

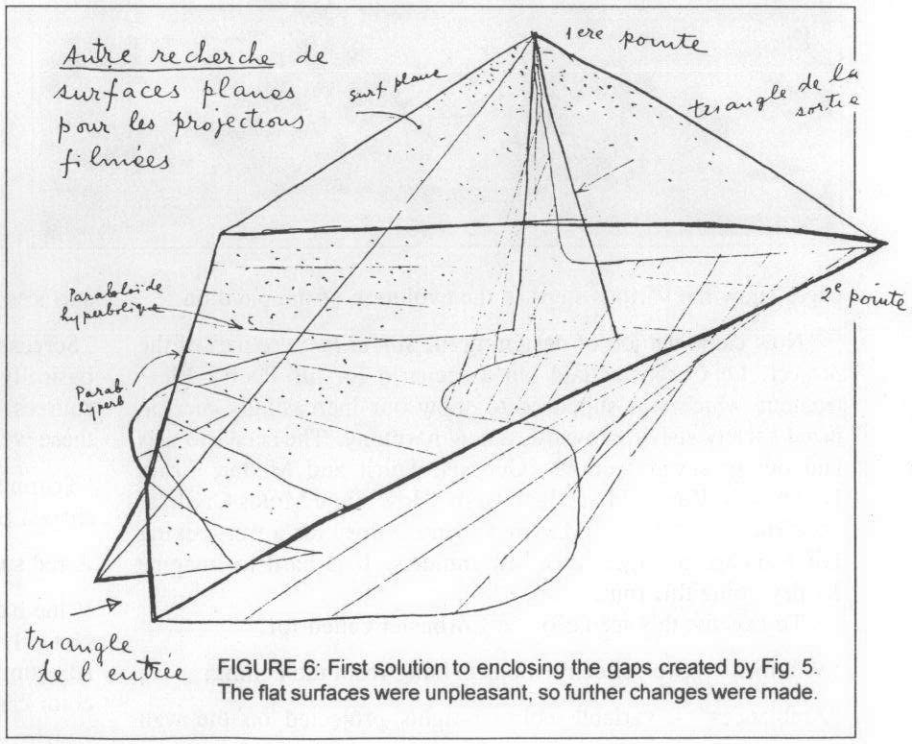


FIGURE 6: First solution to enclosing the gaps created by Fig. 5. The flat surfaces were unpleasant, so further changes were made.

*There is, in actual fact, no real mathematics in Xenakis's work. The "Stochastic Music" described in his *Musiques Formelles* is pseudo-mathematics on a par with that of Joseph Schillinger, who influenced his work. What Xenakis did was, for example, to take a graph of a 90-degree arc of radiating lines, superimpose it on music paper and designate the lines as glissandi for strings. Aesthetically acceptable – Villa-Lobos used the outline of Manhattan as a melodic line – but it's not mathematics.

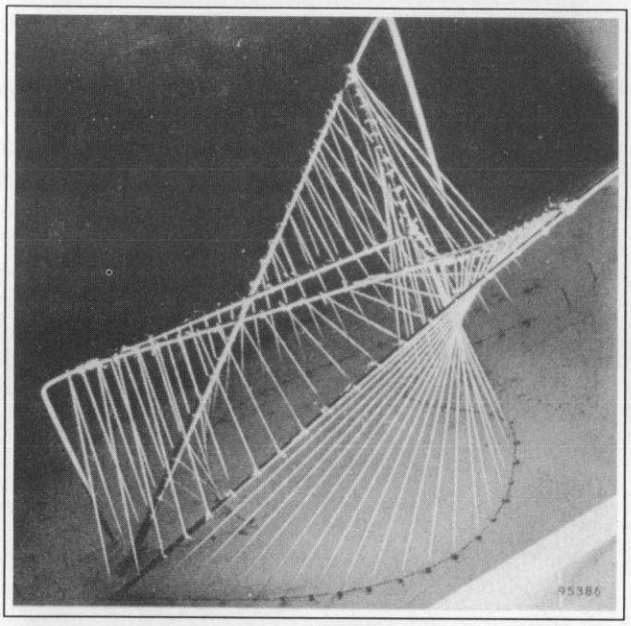
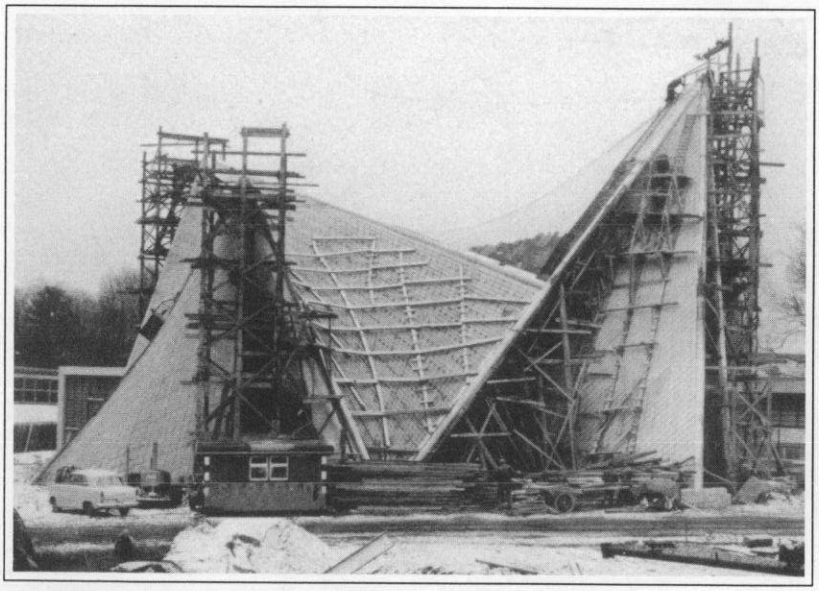


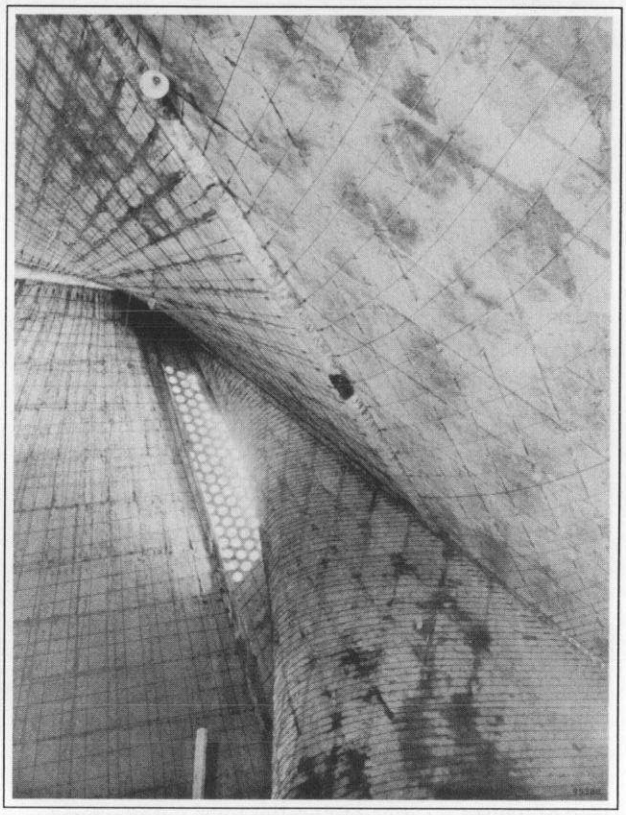
FIGURE 7 (above): Testing of a Xenakis-built model with elastic bands and metal rods.

FIGURE 8 (above right): Highly sophisticated method for testing severe overloading.

FIGURE 9 (below): Construction.

FIGURE10 (right): The completed interior before plastering and installation of audio-video elements, showing the pre-stressing wires.





pages show the various steps in the evolution of the pavilion.

Now came the job of designing the *son et lumière* part of the project. Le Corbusier laid out a scenario for his Poème Électronique which was supposed to show our increasingly mechanized society striving towards a new harmony. The scenario was laid out in seven sections: Genesis; Spirit and Matter; From Darkness to Dawn; Man-Made Gods; How Time Molds Civilization; Harmony; To All Mankind. Quite a dose for a fun-seeking fair audience to digest in a few minutes. It is hard to imagine Disney going this route.

To execute this scenario, Le Corbusier called for:

"Volumes" – two reflective objects hung from the ceiling;

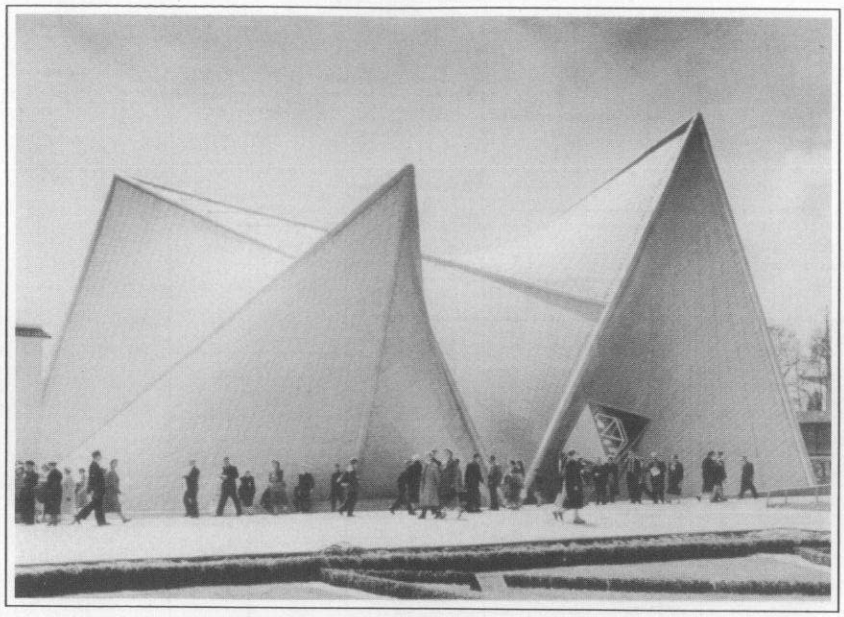
"Ambiances" – variable colored lights projected on the wall surfaces;

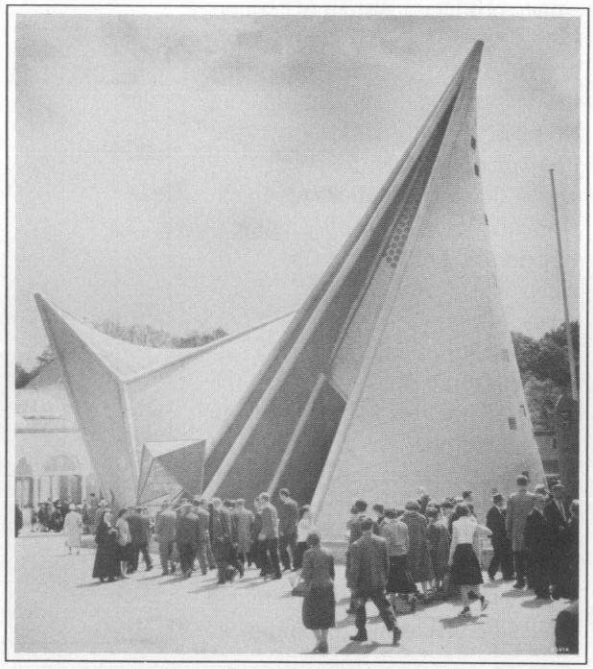
"Screens" – wall areas for slide or film projections. The program basically used black and white slides taken from a wide variety of sources. Since tight timing of slide projectors is almost impossible, these were transferred to film.

"Tritrous" (Threeholes) – film strips, opaque except for three shaped (round, triangular, etc.) clear areas, the "holes."

A red sun, a moon, stars, and clouds.

If the basic elements were simple, the realization was complex. Not only were there a large number of light units but considerable adjusting was needed to avoid "washout" from excess lighting and color cancellation from overlapping complementary colors. The





FIGURES 11 - 12: The completed pavilion

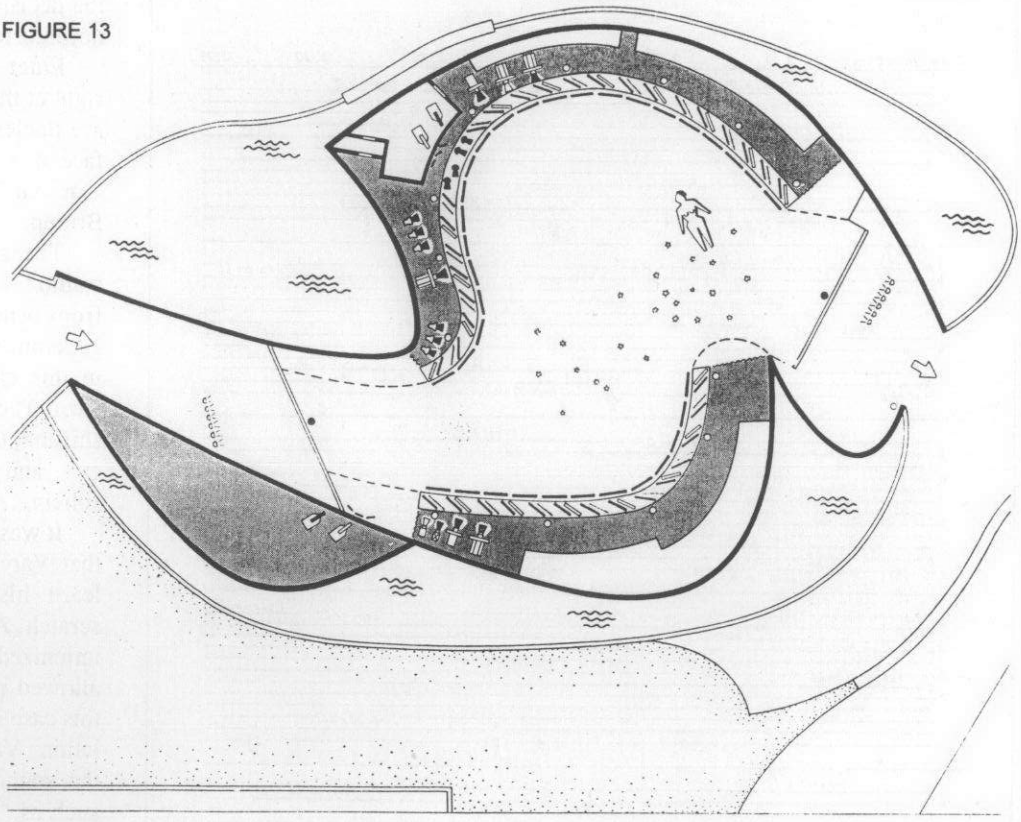
complete system used:

Four cinema-size projectors, four 3KW light projectors with color wheels, two cloud-effect projectors, one projector each for the sun and the moon, six 600W spots, four ultra-violet projectors to excite red and blue fluorescence on the "Volumes," fifty intermittent (Christmas-light style) "stars" in the ceiling, and forty sets of five (white, yellow, red, green, blue) fluorescent tubes hidden behind six-foot high balustrades.

All of these had servo-controlled potentiometers. Even though contemporary arena shows outdistance it, this is an impressive array. The entire layout is shown in Fig. 13.

Finally, there was the sound. The ruling principle laid down by Le Corbusier and his Philips associates was that sounds would be in motion in two ways: first, by the illusion of physical motion across or around the pavilion, and second, by reverberation change from "dry" to "cathedral" and vice versa. The effect of physical motion would be created either by ping-ponging across from groups of speakers over the entrance and over the exit, or by sequences of loudspeakers triggered in succes-

FIGURE 13



sion to produce a system of "sound routes."

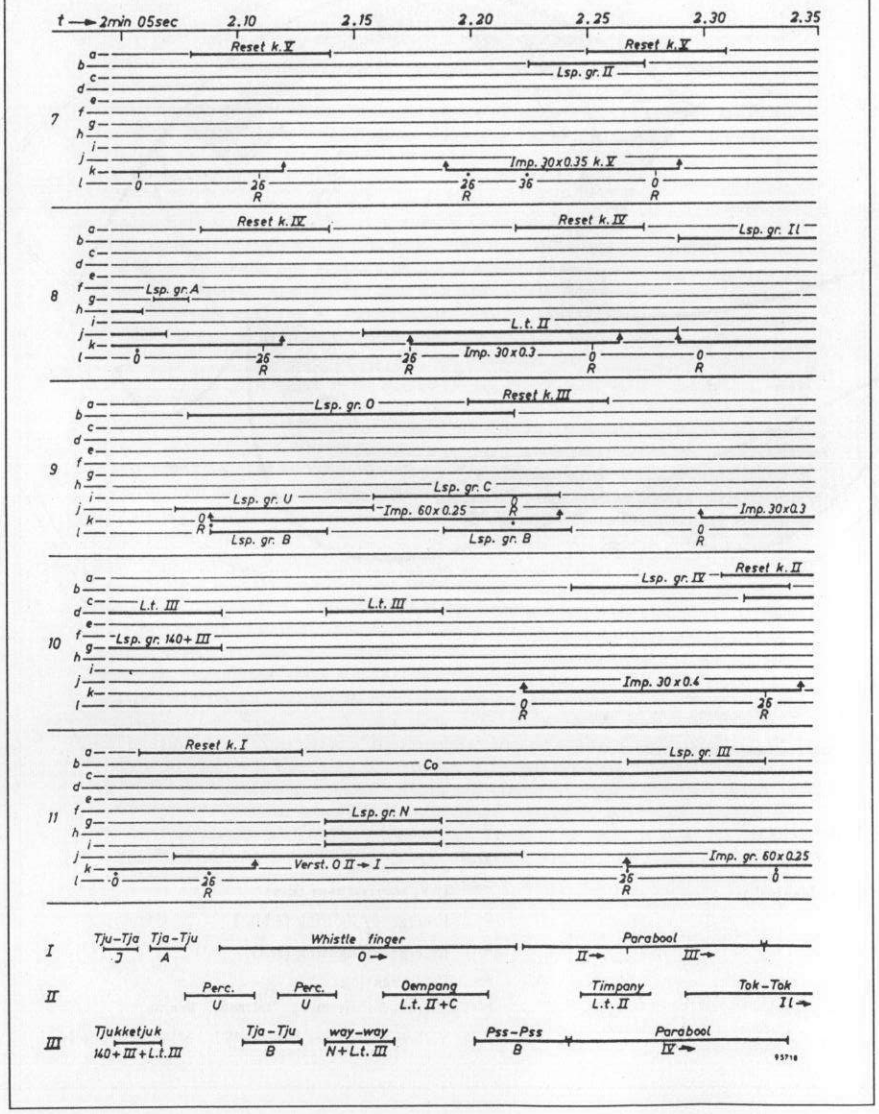
To realize how revolutionary this was, one should recall that the first use of multi-tracking was the pre-war optic track for Walt Disney's "Fantasia," whose technical manual remained the *only* publication in the field for years. Also, electronic reverb was in its infancy.

The Philips engineers also settled on three-track tape for the audio. Three-track remained in use in Europe for a number of years and bedeviled American practitioners (myself included) who could not find ways to transcribe it to two or four tracks. It was also decided that the music would be electronic, meaning, as

FIGURE 14

Sec	Volumes Mat	Volumes Fon	Ecrans Notes	Ecrans Vision	Ecrans Référence	Sec.	Tritons	Paroles
81				Les quatre savants	T.113	81	Les quatre savants dans les trous éclairés en couleur bleu et rouge.	
82						82		
83						83		
84			Toutes ces têtes seront animées, c'est-à-dire qu'il faut à tout prix éviter la monotonie et la lontour. Cela doit être vivant	Tête de nègre Congo	T.114	84		
85				Tête de nègre Maori	T.116	85		
86				Tête de nègre Mayogo	T.117	86		
87				Tête de fille Longbetu	T.118	87		
88				Courbet: femme couchée	D.121	88	Les tritons en couleur bleu et rouge.	
89				Art Attique MAL 89	D.124	89		
90				Art Sumérien MAL 11	D.125	90		
91				Egypte MAL 68	D.128	91		
92				Dame D'Echo MAL 94	D.130	92		
93				Art Sumérien MAL 11	D.125	93		
94				César MAL 171	D.133	94		
95				Art Celtique MAL 212	D.135	95		

FIGURE 15



they put it, "music whose actual composition is based on the use of electronic devices." Finally, the decision was made that sight and sound would not interrelate.

Enter Edgard Varèse. Le Corbusier chose him right at the start, though the reasons for the choice are unclear, and steadfastly supported him in the face of management, who had qualms about his "far out" reputation, and who wanted Benjamin Britten.

The sound tracks were realized by "classic studio" techniques, i.e. sounds were produced from bench equipment – sine, sawtooth, or noise generators, etc. – or were pre-recorded (including in this case piano, chimes, voice, "workshop," etc.). These were modified by filtering, frequency shifting, etc., or by altering tape speed or direction, etc., and then montaged by overdubbing or tape splicing.

It was laborious work made more so by the fact that Varèse was a novice in the field and had to learn his way around studio equipment from scratch. As was the practice in the state-sponsored, unionized European studios, composers were not allowed near the equipment, and a technician, in this case J. W. de Bruyn, did all the actual manipulation. Varèse concentrated on the "character" of the sound, indicating his desires by instructions such as "more nasal," "less biting," "more rasping," and such like. The spatial distribution of the sounds was entirely in the hands of Philips technicians. Unlike Disney, audio and controls were magnetic, not optic, but like Disney, for exact synchronization they were on 35mm perforated film and were driven by high-accuracy synchronous motors.

On one tape were the three audio tracks as noted; on a second tape there were 15 control tracks, each with 12 separate control signals each

represented by a discrete frequency between 900Hz and 10.5KHz which could be pulled out by a selective (notch filter) amplifier for a total of 180 control channels. (A duplicate backup system gave a grand total of 360 channels. Note that one of Philips's major fields was automatic control.) The audio output went to 350 loudspeakers, 25 of them high-output woofers, fed by an array of 120W amplifiers.

The sequence of sounds and lights was very exactly planned, starting with a second-by-second chart of the visual elements drawn up by Le Corbusier (Fig. 14) and ending with an exact layout of the audio and control channels from which the control tape was painstakingly made.

Fig. 15 shows one page of the audio-control tapes diagram running .30 seconds. The three-track audio is at the bottom. Note the onomato-poeia used to characterize most sounds. Above them are control tracks 7-11 each subdivided into 12 channels a-l (60 of the 180 channels). For example, the sound "Tja-Tju" on Audio Track 1 is routed to speaker A by the control signal 8g, which turns it on and off. "Whistle Finger" has to go to the "sound route" 0. The sound is shunted by channel 11k to Track 1 output (normally used for "routes") and channel 9b turns the "route" (whose sequence is on channels not here shown) on and off. And so forth.

All of this for an eight-minute show preceded by a two-minute interlude created by Xenakis and a short introduction in three languages, all of which was repeated about twenty times a day for audiences that would now be considered minuscule. It was, however, an artistic entity that would reward repeated viewing with increased insights.

Modern rock light shows have even heavier artillery, but the aesthetic approach is that of a tank attack. Just as film-makers now assume that more and bigger crashes and pyrotechnics make for a better film, rock show *son et lumière* assumes that more lasers and bigger amps mean better concerts. As Marc Treib puts it, the rapid intercutting of images has become "the staple of MTV, where fractional second editing replaces content, and syntax supersedes semantics or becomes semantics" [Marc Treib, *Space Calculated in Seconds*, p. 139].

The building was not conceived as a permanent structure nor designed to withstand winter – pre-stressing wires would rust, electronics were not winterized – so, in spite of appeals by Le Corbusier and others, management made its decision and at 2:00 p.m., January 20, 1959, the Electronic Poem was reduced to rubble.

FURTHER SOURCES

An excellent source for further information on the Philips Pavilion of 1958 is *Space Calculated in Seconds: The Philips Pavilion, Le Corbusier, Edgard Varèse*, by Marc Treib (Princeton University Press, 1996). I became aware of this work only after I had completed the adjoining article. It was comforting to find that the building had survived as something more than just Philips files. The work is very comprehensive and concentrates primarily on the problems and solutions and on the personal conflicts between and contributions made by various parties, and is a fascinating, well-written, and heavily illustrated account of the Pavilion. A must for those interested in the artistic revolution that followed World War II. Good bibliography.

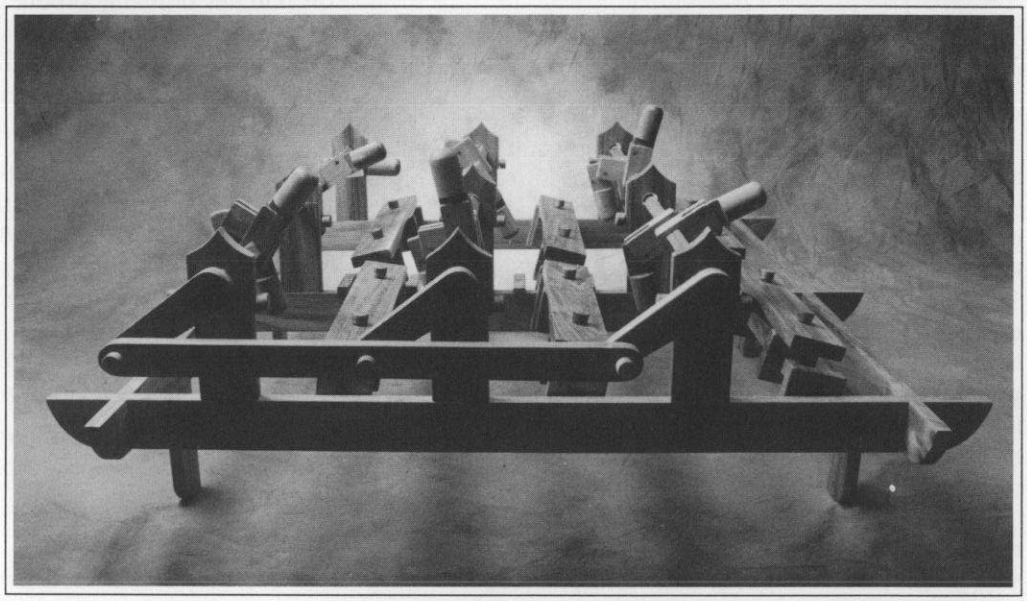
The book does not include, even as an appendix, the actual math and technical procedures. For these the reader should try to locate the *Philips Technical Reviews* for 1958. These were company-produced periodicals aimed at architectural, mathematical, and other technically oriented readers and are the primary sources of information on the Pavilion. They are hard to find; if public or university libraries do not have them, one might try the Philips Research Facility, Building WB22, Prof. Holstlaan 4 5666 AA, Eindhoven, The Netherlands.

Varèse's rather personal account of the sound is found in Schwartz and Childs, *Contemporary Composers on Contemporary Music* (Holt, Rinehart and Winston, 1967).

Ray Wilding-White is a composer of over a hundred works from electronic pieces and chamber works to choral and symphonic compositions, widely performed by prominent ensembles and in noted venues. He has also been active as a promoter of new music, as a jazz painist and arranger, and as a photographer.

HUNKA HUNKA CHURNIN' WOOD — A 2x4 CONTEST ENTRY

by Art Liestman



As I reported in an earlier *EMI* article,* I am a member of the Pacific Woodworkers Guild, a club for woodworkers in the Vancouver, B.C. area, which has an annual event called the "2x4 Contest." The rules are simple: each contestant is to make any project from a single piece of wood that measures 2 inches by 4 inches by 8 feet. The only materials allowed in addition to this single piece of wood are glue and finishing products (such as stain or varnish). The contest entries are judged on originality, efficient use of material, effective use of material, complexity, and craftsmanship. The constraint to use only (and all of) the single 2x4 requires that almost all design decisions are made well in advance of the first cut and leaves little room for error.

For the 1996 contest, I made a set of four walnut instruments inspired by the Indonesian bamboo angklung. When the entries were judged, I needed to demonstrate the instrument to the assembled masses. Since the only people in attendance were woodworkers, I attempted to play one of the angklung while directing three of my woodworking friends to play their interlocking parts. The result sounded, shall we say, "unrehearsed." As a result, when it came time to plan for the 1997 contest, I resolved to make an instrument that could be played by a single performer.

My initial idea was to make a programmable automatic xylophone. The instrument would play a fixed pattern with the turn of a crank and could be programmed to play different patterns. I chose to use an Indonesian scale (since Indonesian music is based on repeating patterns) and fixed on six notes of a pentatonic (slendro) scale. I also decided that it would be much better if the pattern could be somehow altered during playing time.

The overall idea was to have tone bars mounted in a frame with axles rotating above them. Hammers mounted on the axles would be placed so as to fall on the bars, sounding the tones. The rhythmic pattern of the notes would be determined by the position of the hammers around the axle. The basic idea of hammers on a rotating axle was suggested by a whirligig from Indonesia that I have had for several years.

A hammer is constructed somewhat like an arm. The upper arm section contains a hole through which the axle passes. The upper arm remains in a fixed position, relative to the rotating axle. The lower arm is the striking portion. It has a tab which fits into a slot in the upper arm section. The two pieces are connected by a dowel at the elbow which allows the arm to bend. As the axle rotates, the lower arm moves between the two extreme positions. After striking the bar, the arm bends to pass the bar and then remains bent as it rotates. In the bent position, the two portions of the arm are at about 45 degrees to each other. When the arm passes the position where the lower arm is pointing straight up, gravity rears its ugly head and the lower arm falls to an angle which is at about 180 degrees from the upper arm's position. The tone bar is placed so that the lower arm hits it just before it reaches this 180 degree position.

In order to accurately position the hammers around the axle, I used axles which were square in cross-section (except for short rounded sections which pass through the support towers and allow smooth rotation). A hammer, with its square hole, can be slipped onto the axle in any of four positions - each separated by 90 degrees from the next.

This alone allows four beats per rotation. By making versions of the hammer with the holes at different angles, the number of beats is multiplied. In particular, by making versions with the holes angled at 0 degrees, 22.5 degrees, 45 degrees, and 67.5 degrees, I obtained 16 equally spaced beats per rotation, allowing 16 beat repeating patterns to be programmed. (This idea can obviously be extended to allow other pattern lengths.) The axles can be removed from the support towers to allow reprogramming and are connected by an arm and bar mechanism at one end so that they rotate in unison.

The tone bars are tuned as other marimba/xylophone bars, that is, they are roughly tuned by length with the fine tuning done

* A. Liestman, "Walnut Angklung — a 2x4 Contest Entry," *Experimental Musical Instruments*, Vol. 12, number 3, March 1997, pp. 28 — 29.

by removing material from the underside of the bar. The bars are tuned to an ascending scale which is (roughly) G, A, C, D, E, G. Each bar has two holes, located at the nodes, through which pegs pass to hold them loosely to the support piece which runs across the tone bar. Since no other materials are allowed, it wasn't possible to put a piece of felt or rubber between the bar and the support piece. The tone is, obviously, affected by this. These supports under the two nodes are joined by a narrow rail which passes through the supports and connects to end blocks beyond each end of the tone bar. These end blocks have holes in them which fit over pegs extending from the frame. This allows the tone bar assembly — tone bar, supports, rail, and end blocks — to pivot so that the tone bar can be moved in and out of playing position. The extent of the pivoting in each direction is controlled by a small wooden stop on the frame which contacts the end block and prevents further motion. The tone bars are of various lengths and allow a maximum of between four and six hammers to be positioned above each.

In order to be able to reach all of the tone bars (to pivot them) while turning the crank, I chose to have three parallel axles with two tone bars under each. The frame is about 30" square which is a convenient size for playing. It is raised on legs to enable bar pivoting to be done by reaching underneath the bars. In fact, I usually stand to play the instrument and it is easier to do the pivoting from above the bars.

The frame supports nine towers, three per axle, which hold the axles in position above the tone bars. The top of each tower is a cap that can be removed by extracting two horizontal pins that hold the cap to the body of the tower. Removing all of the caps allows the instrument to be reprogrammed to play a different pattern, by sliding the hammers off of the axles and putting a new set of hammers on in different positions. The frame is connected with half lap joints. The towers and legs are connected to it with mortise and tenon joints.

I chose to construct the instrument out of black locust wood which is strong, somewhat heavy, and attractive. The ends of the frame, the tower caps, and the legs are decorated with simple curves to give the instrument a vaguely Indonesian feel. The instrument was finished with Danish oil.

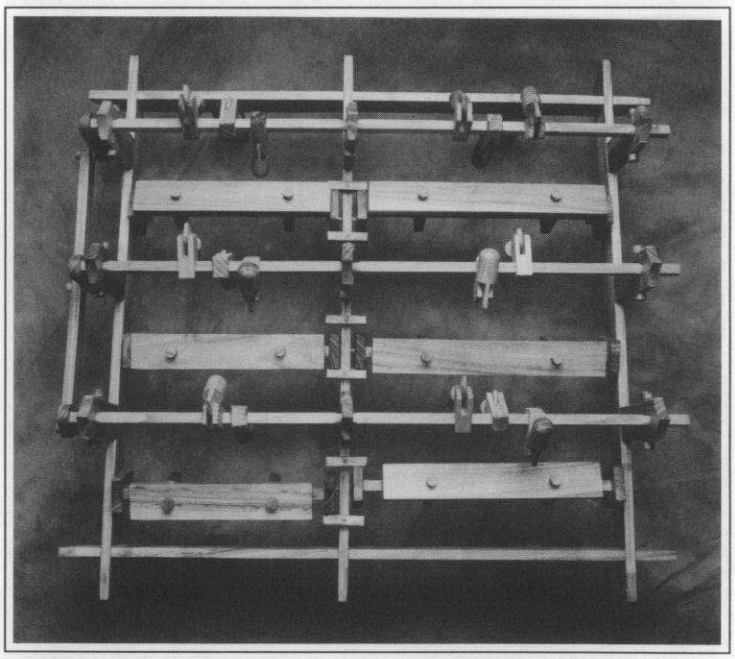
One of the last decisions was to give a name to the instrument. My brother suggested "Hunka Hunka Churnin' Wood" which I immediately adopted. (Close friends just call it "Hunka.")

On the night of the competition, I arrived early to put my entry in the display area. It was interesting watching guild members ponder over the purpose of this odd contraption. After the business meeting, the contest began and each contestant had a few minutes to describe his or her entry. I explained that my entry was a programmable automatic xylophone and that it was currently programmed to play a 16-note portion of an Indonesian melody taken from a book on gamelan. I began Hunka's first public performance. Initially, all of the tone bars were in the "off" position. During the first two or three rotations of the axles, the only sound was the click of the hammers. I pivoted the lowest pitched note into playing position and the sound changed — a low note was added to the clicking. I added the notes one at a time from lowest to highest pitch, adding one note after every two or three rotations. Finally, the entire pattern was audible. Over the next dozen or so rotations I modified the pattern, first by removing a couple of notes, then adding one back and removing another, and so on. To end the performance, I removed the notes from the full pattern in the reverse order from which they first entered. Finally, after listening to just the hammers clicking for two rotations, I stopped. I answered a few questions about the instrument and its construction and then relinquished the stage to the next presenter.

After all of the entries had been shown, the members voted to determine the four prize winners. The tension mounted. Last year I had taken second prize. For the past year, I had concentrated on beating Marco, my friend who had won first prize. The prizes were announced in reverse order. Fourth, then third, were announced. Finally, second prize — Marco! A hush fell over the crowd. The mighty Marco had been defeated. First prize ..... Hunka! I was shocked and Marco was the first to congratulate me. It was a glorious evening.

On the drive home, the horrible reality set in. What can I do for next year? What will Marco devise? What have I done to myself? Stay tuned for the next installment.

Art Liestman is an amateur instrument maker and semi-retired drummer. He generally makes various drums based on African and Cuban originals but occasionally makes something slightly unusual. He can be reached (at his day job) at art@cs.sfu.ca.

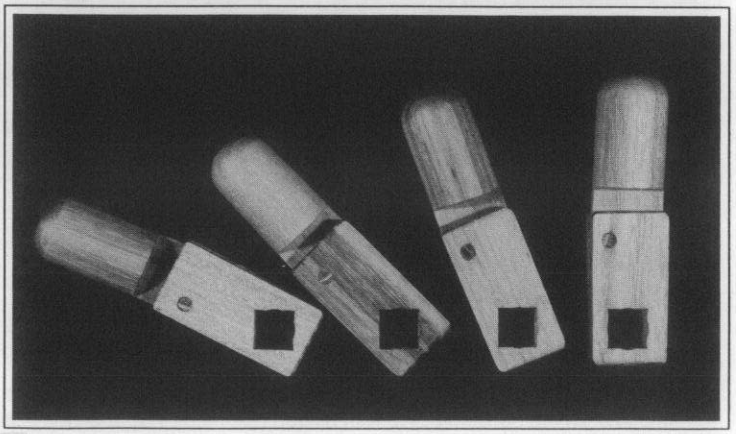


Photo, facing page: Hunka Hunka Churnin' Wood, front view

This page, above: Top view

Below: Four of the hammers

Photos by Greg Ehlers



EMPTY VESSELS

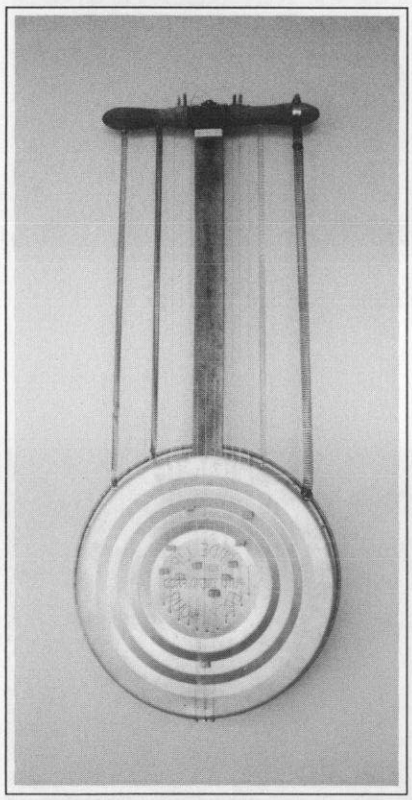
Readymade Resonators for String Instruments

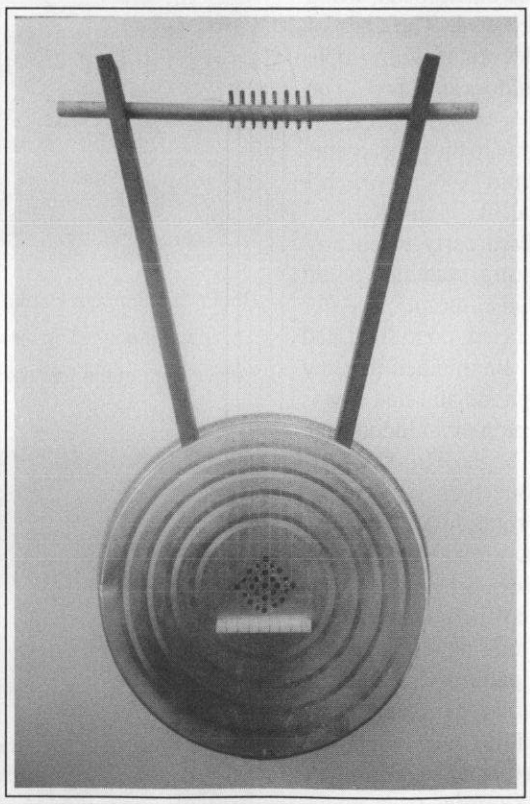
By Peter Whitehead

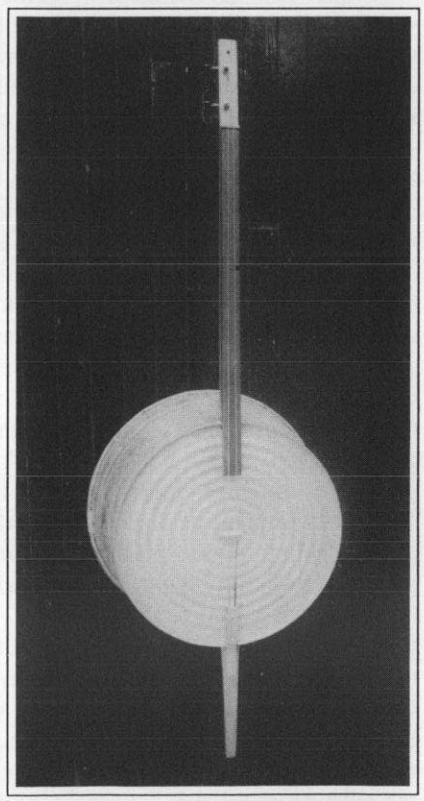
In recent years I have made a number of string instruments using found or bought containers of various shapes and forms as the resonators and/or sound boards. This is by no means an original idea, and in my case was first inspired by the book *Musical Instruments of the Southern Appalachian Mountains* by John Rice Irwin, published by Schiffer Publishing (loaned to me by my friend and fellow instrument builder Norman Rutherford). This book contains numerous examples of the use of readymade containers in the building of string instruments as well as many other interesting folk instruments built in more conventional ways. What interested me mostly at first were the banjo-type instruments which had been constructed from leftover metal containers made for a variety of things such as cookies or ham, and in some cases metal objects that had been perhaps bought specifically for the purpose of building an instrument, such as pie tins. This was obviously a choice mostly made out of the restrictions of poverty and the desire to make music out of what is available or inexpensive, an idea which has always appealed to me. It's also interesting to transform an apparently unmusical object into an instrument. Apart from anything, I was curious to know what these kinds of instruments sounded like.

So I set to work, having never made a string instrument before, knowing them to be somewhat difficult instruments for a beginner, but encouraged by the simplicity of the constructions and the availability of materials. I made my first banjo using a 12" cookie tin, a length of oak and some old guitar tuning pegs. I bought some fret wire and placed the frets by ear, built a small wedge-shaped bridge and added some old guitar strings. Unfortunately this was not a very successful instrument, but somehow I felt inspired enough to continue. As often happens with this kind of process, I was sure I could improve by learning from what was not working.

My first successful attempt came with a 16" oil pan which I had previously bought to use as a gong. After using it repeatedly in performance it had lost the sound I liked and seemed a good candidate for a banjo body. Using the method of placing the neck



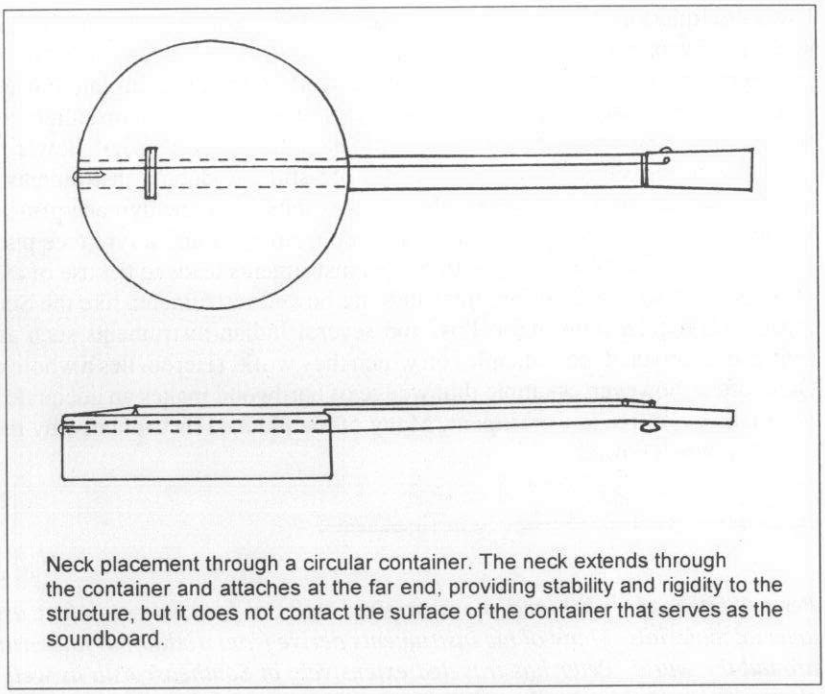




READYMADE RESONATOR INSTRUMENTS BY PETER WHITEHEAD. Left: Lawn lyre, with adjustable bridges (some of them being flat, buzzing bridges). Center: 8-String Lyre with oil pan resonator. Right: 2-string Stand-up Wash Tub Bass with wash tub resonator. All photos by Peter Whitehead

all the way through the pan that I had seen in the book, I built an instrument with a resulting sound somewhere between a steel guitar and a sarod. (See upper photo on page 20.) Subsequent attempts at improving the tone and volume were even more successful.

Certain factors seemed to be critical for this. Apart from the inherent qualities of the container itself, the most important of these appears to be the placement of the bridge and the size and shape of it. I have found that placing the bridge about a quarter of the way across the diameter seems to be optimum. Of course this is a personal choice, but it seems there is always some compromise between unusual tone and loud volume. Often a simple thin wedge of hardwood held in place by the string tension works quite well as a bridge, but in some cases I have supported this on a thin strip of wood with more surface area to distribute the pressure more evenly, which improves the bass and clarifies the tone. The neck continuing through the body is an ideal solution to the problem of fixing it to a thin metal body and is good for those not expert in neck construction, which can become involved.

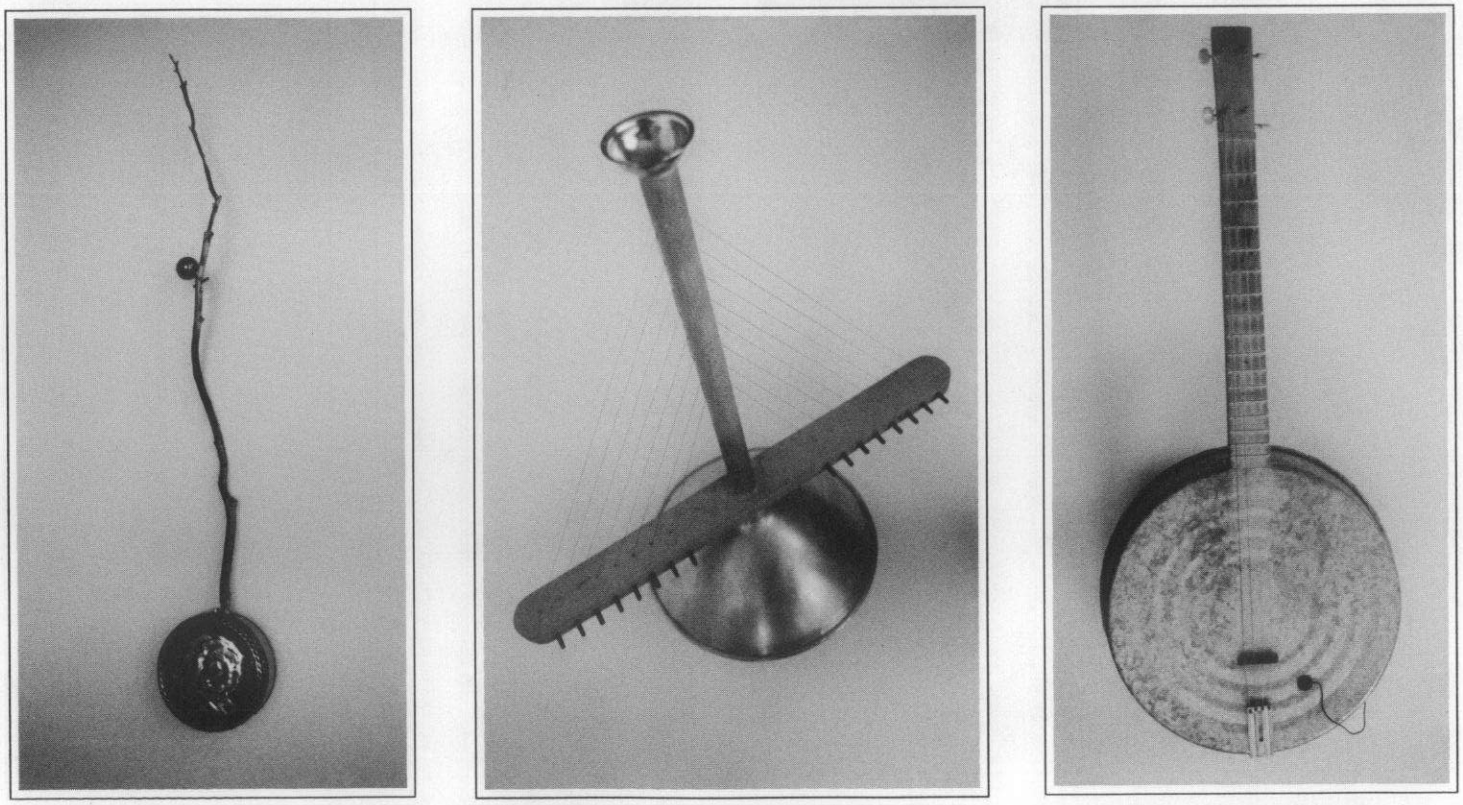


Neck placement through a circular container. The neck extends through the container and attaches at the far end, providing stability and rigidity to the structure, but it does not contact the surface of the container that serves as the soundboard.

Many kinds of metal containers can work well if the metal is not too thin. It needs to be fairly thick, yet not too rigid (like a frying pan would be). You can test containers by playing them like drums: a container with a good solid clear tone will probably work well. Thicker metal will go better with heavier gauge strings.

Fret placement can be done by ear, a method that works well if you have a good ear, or you can use a tuner. Alternatively, you can use the methods described on page 133 of Bart Hopkin's book *Musical Instrument Design* (See Sharp Press, 1996; available through *Experimental Musical Instruments*). The simplest of these, which gives reasonably accurate if not perfect fret placements for the standard equal-tempered scale, is the traditional method known as "The Rule of 18:" Place the frets so that each successive fret shortens the sounding string length by $1/18^{th}$ relative to the previous fret.

Having made three or four of these instruments I began branching out into other readymade containers, keeping my eye out for unusual or attractive ones in thrift stores. About this time

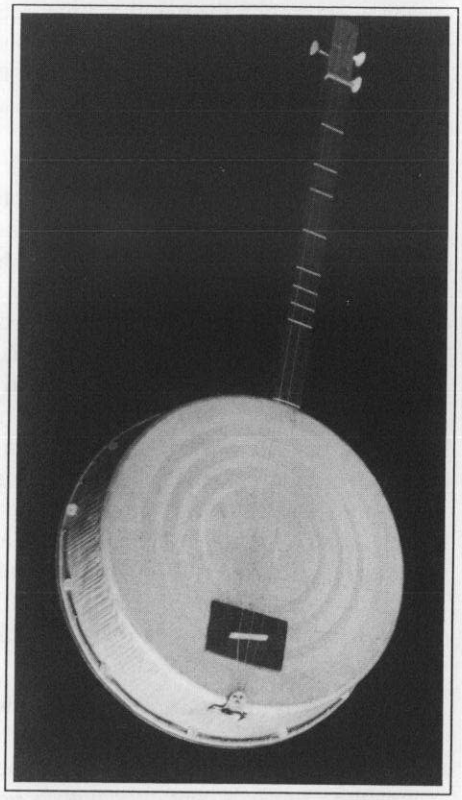


Left: Musical Bow, from a cookie tin and branch. Center: Double Harp with light-shade resonator. Right: Early Panjo or Canjo with pickup.

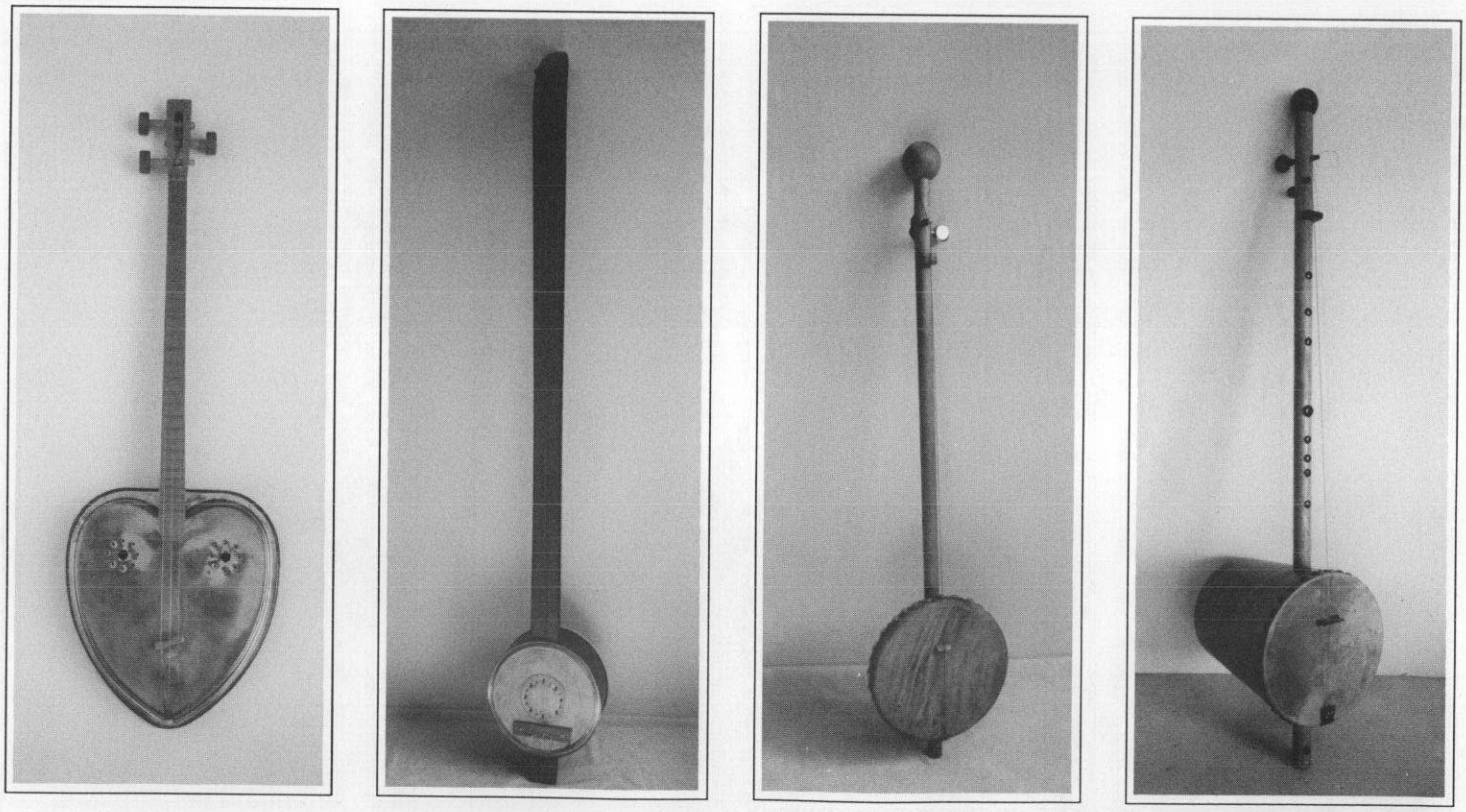
I was commissioned to make several banjo-type instruments for friends and following similar principals I constructed a stand up bass using a galvanized metal wash tub and later some more lutes using pie tins. Subsequently I branched out into bowed instruments using wooden vessels as resonators with goat skin stretched across them to serve as the soundboard, and eventually to more plucked lutes using salad bowls with wooden soundboards. Some of these were very successful, producing instruments with a clear, bright tone and good volume. Further applications of the readymade principle produced musical bows, a tamboura with a neck made from a ski and a lyre (see photos).

The movement from plucked to bowed instruments leads to the use of a different kind of bridge and so I spent some time studying bowed instruments like the Southeast Asian rebabs, classical violins and cellos, and several Indian instruments such as the sarangi, trying to understand the principles on which they work. (Herein lies a whole other article). Quite often, however, a simple thin wedge of hardwood makes an adequate bridge — but as usual we are free to experiment. Many of the plucked instruments, by the way, sound excellent when bowed.

Peter Whitehead makes and plays original musical instruments, often using found or unusual materials. Many of his instruments derive from traditional folk instruments from around the world. Peter has traveled extensively in Southeast Asia as well as India and North Africa, and has collected instruments and music along the way. As well as doing live performance he has established a reputation as a composer for dance & film. His instruments have been exhibited in several museums. Originally born in England, he now lives in San Francisco, and can be reached at 455A Valencia St., San Francisco CA 94103. Cassettes of his music are available. He has seven pairs of shoes.



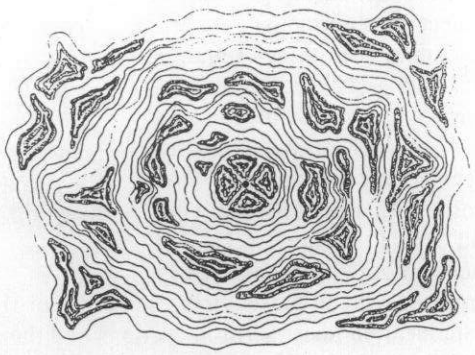
Above: Diatonic banjo (or canjo) with metal oil pan resonator.



Left: Heart-shaped Panjo with baking tin resonator. Center left: Ski Tamboura, from a ski and cookie tin. Center right: One-String, bowed rebab with wooden salad bowl resonator. Right: Two-string, bowed rebab, with wooden ice bucket resonator.

A SONIC ODYSSEY AND QUEST FOR CLARITY

By Peter Horsefield



My interest in musical instruments began at ten years old with the skiffle craze. Not only was the music different, exciting and very definitely of the time; the instruments were often home-made: the tea chest bass, the washboard and the one-string guitar made from a broom handle stuck into the side of a cake tin and strung with nylon fishing line. I made one of these guitars, but didn't like the flat, thin sound. Unable to afford a real guitar, I decided to make one. I had made model airplanes from kits, so that's where I started. Without plans, I drew what was essentially a large ukulele directly onto the sheets of balsa and proceeded from there. Frets were painted on without regard to mathematical formulae, and friction pegs held the nylon strings. It worked until I began to tune up the strings when, not surprisingly, the whole thing collapsed. A salutary lesson in structural engineering. Then, five years later, using oak and oak ply from an old wardrobe, I built a seriously cut-down electric solid-body. I used a pair of dividers to measure off the fret positions on the guitar on the cover of Duane Eddy's *A Million Dollars Worth of Twang* and then scaled them up. Two cheap microphone inserts set into the body acted as pickups. A homemade tremolo completed it. When plugged into an old valve radio it impressed the neighbors and I sold it for slightly more than cost.

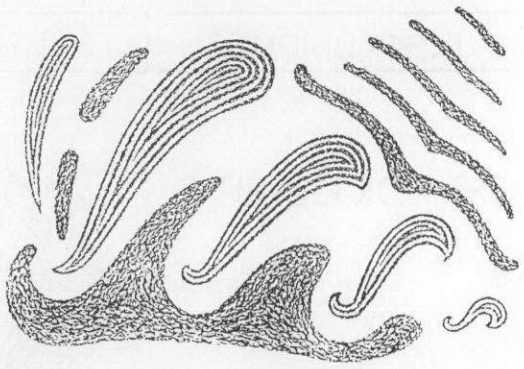
It was 1974 before I was taken with making another instrument. This time I approached it in a more structured manner and read all the books I could find as well as visiting museums and collections. Over a four-year period I built and sold thirty-six "tear drop" three- and six-string Appalachian dulcimers. I made one twin-neck with six and three that had a 3" deep body. It was very resonant and looked rather like those guitars favored by rock musicians of the time. By the time I finished the last one the weight had been reduced by 50% and the internal structure completely reworked. All this improved the sound tremendously. Significant contributors to the weight were the metal tuning pegs. Without resorting to nylon strings and wooden pegs there was no further way to reduce it. However, the basic design of the dulcimer doesn't suit nylon strings.

Gillian Carcas and Matthew Gunn playing both harps together for the first time in the newly opened Gymnasium Art Gallery of Berwick on Tweed

During this time I had begun to appreciate the harp for its almost magical qualities, and to realize to what extent the shape of the body affects the sound. This is apparent in all acoustic instruments and is a major reason why players of early music prefer instruments designed for the time. For a while I made and repaired copies of such instruments for the Early Music Shop in Bradford. To follow the evolution of any instrument from its beginning to the present is to realize just how complex is the relationship between shape and sound. Even a subtle change of form will have some effect. The change from gut to metal strings had a part to play in this too. The extra tension required a stronger structure. This extra material had to be incorporated in a way that did not diminish the power gained by using metal strings.

It was also during this period that I became captivated by kites

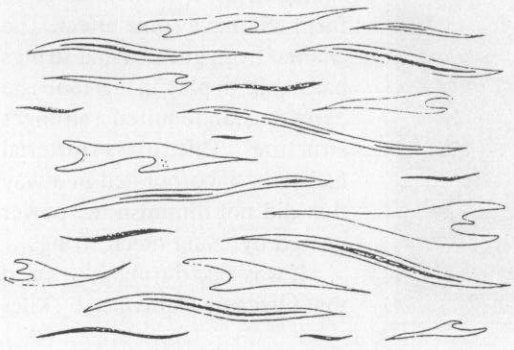
and the history of unpowered flight. Any engineered structure that functions within the wind (tents, sails, kites, gliders) is subject to enormous stresses. Designing such things requires a balancing of tension and structure to be successful. This is also true of stringed instruments. Time and again I found cross-resonances between wind and sound. Guitar necks and yacht masts, harps and early airplanes with all those wires, flexibility or rigidity, natural materials compared to manufactured ones, aerofoil sections and the shapes of acoustic chambers.



When I finally decided to build a harp in '81 I had certain acoustic ideas in mind. The sound was to be ethereal yet powerful, loud but not strident, subtle yet complex. All the harps I'd seen were incredibly heavy. Most had metal pegs and strings. Far too much of the structure seemed to be there to stop the whole thing collapsing. This dead weight would actually diminish the final sound. I played around on paper with various ideas based on a traditional harp shape but kept coming back to the same problems. A complete rethink was needed. Firstly I decided on nylon strings for their quality of sound. This meant wooden pegs, but even nylon strings require a substantial structure. I had just spent several months as a sail maker in Santa Barbara and the yacht mast came readily to mind. There is the tree-trunk approach or the braced-stick design. I could balance tension against tension and thus immediately start to reduce structural bulk. I was also aware that holding an instrument dampens the sound. My harp would have to stand alone.

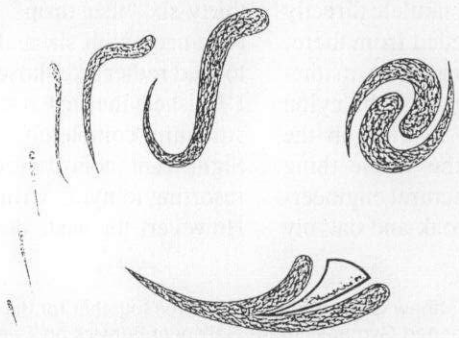
The basic structural form then became easy to visualize: two opposed curved sound boards separated by two end pieces-cum-pegboxes, the final tuning to be achieved with movable bridges. Each soundboard would have its own set of strings. Thus the opposing tensions would allow for some imaginative structural reduction. I had planned to use sides so that the whole structure resembled a hollow marimba bar. This proved problematical and they were left out of the design. Consequently there was no need for the intended sound holes in the end pieces. Instead I was able to use the spaces between the edges of the soundboards. This also meant the edges were free to vibrate.

I am aware that this structural configuration would be considered non-harp using the Hornbostel and Sachs system of classification. However, it would give me the harp sound that I wanted and not the "zitherishmess" associated with instruments so defined. Musical instruments are appreciated and used because of their sound qualities, not the nuances of their structural design. Perhaps they should be reclassified accordingly?



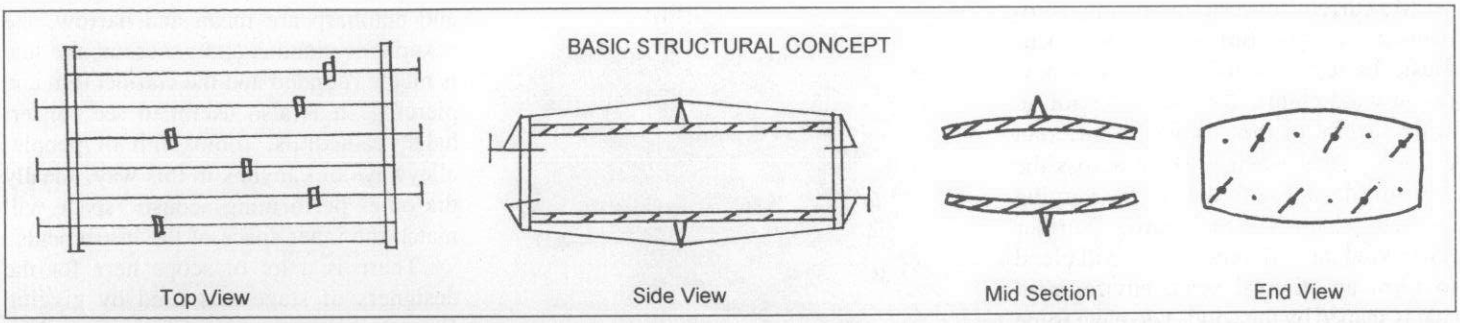
The first instrument I made has 30 strings across one side and 10 on the other. I used nylon guitar strings which gave me a maximum sound-board length of 30". They were made from 4" strips of pine glued together and thicknessed to approximately ¼" so that I could bend them, with what felt like the right tension, to the required curvature. A 1" x ¼" pre-curved pine cross brace was glued to the underside of each board across the middle. In practice the middle of each board has a slightly flatter curvature than the ends. This changes with string tension and bridge position. Thus the musical composition and shape of the resonating space are intimately connected. It soon became apparent that a $^{5}/_{8}$" diameter pine sound post would be needed to stop the boards depressing when too many bridges were in the middle. It also improved volume, resonance and sustain profoundly. The bridges are 1" high and made from $^{1}/_{8}$" ramin.

A great deal of attention was paid to the peg boxes. I wanted a very clean, simple and elegant design with the strings and pegs working effectively, yet all the functional aspects to be hidden inside the structure of the peg boxes. This entailed a three-ply construction of sycamore outers and mahogany inner. The middle had to be cut to allow room for the wound-on string and drilled vertically as a lead-down to the peg. These are rosewood violin pegs drilled as shown. The string is threaded down through the peg box and out through the side so that it can then be threaded through the peg and knotted. Similarly at the other end the string is threaded down, out the side and knotted. Both ends are then tucked neatly away. On the second version of the instrument that I made, I drilled the pegs so that the knot is inside the instrument. Much neater and easier to drill.



The images on these pages are sound and wind drawings from Peter Horsefield's booklet *The Natural Resonance of Structureless Form.*

Now I had a harp-sounding instrument. It needed a stand and case. The case was made from $^{1}/_{8}$" birch ply and ramin molding. For storage and transportation, cotton-covered one-inch foam mats are put into the base and lid with the instrument sandwiched between. During performance, these are used as cushions by the player. The stand is composed of three pieces of ¼" birch ply that slot together. It is notched to fit on the soundboards next to the peg boxes and sits on the case. Surprisingly, the case acts as a secondary resonating chamber. When I made the second instrument I bore this in mind. I used $^{1}/_{8}$" mahogany ply that had a thick central core and thin outer veneers. A piece held gently by a corner and tapped had a usable amount of ring to it. I ensured that the inside was free of protuberances, making it acoustically bright. The lid slides in like a pencil box and is left partially open in performance, being adjusted to suit the player. The case sits on two leather-covered ramin rails placed in the nodal position of the box in the same way that a marimba bar



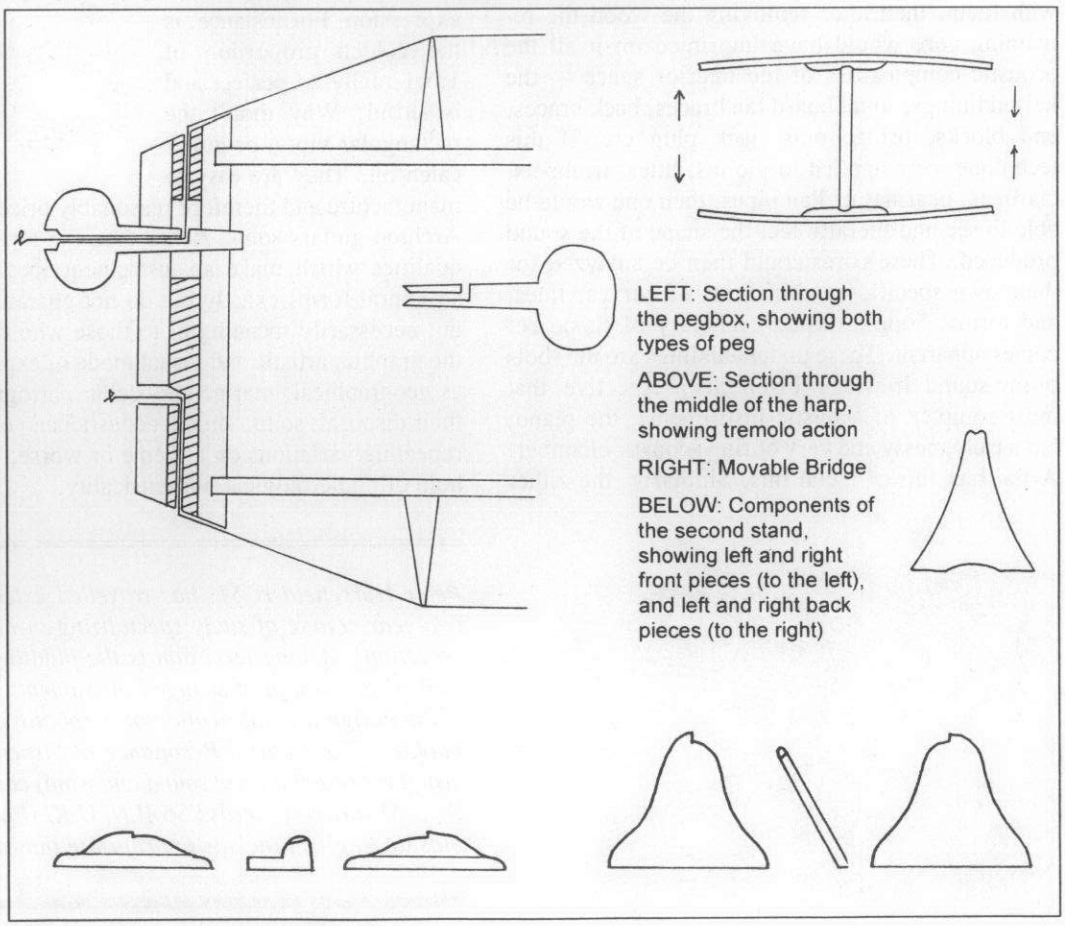
is supported. Again, the player sits on the foam mats.

The stand for the second harp had to differ from the first as I had extended the sides of the soundboards beyond the peg boxes to give a longer vibrating edge. It consists of four separate mahogany pieces. Two fit under the far side and lock against the edge moulding of the case. The other pieces support the near side and likewise fit against the moulding. They all notch onto the lower soundboard next to the peg boxes. All this produces a decent sustain and richness of tone. I also re-thought the sound post and curved the ends so that they fit into matching notches on the shorter cross braces. This allows the player to gently squeeze together the edges of the sound boards on one side, thereby opening up the other side and varying string tension. A simple and effective tremolo. It is strung with the new type of braided and polished nylon harp strings, sixteen on one side and six on the other giving a board length of 40".

This second instrument was designed specifically to provide a sound that correlates with the bass notes in the paintings of James Hugonin. His works are physically big yet aesthetically understated. They are objects of contemplation, quietly and powerfully present. This I brought into the sound as well as the sculptural form of the structure. Curiously, looking from an oblique angle through the instrument there is more than a passing resemblance to the first Wright Brothers' glider. The mahogany bridges had to be much higher to prevent them slapping around in the middle of the sound board. I provided three sizes — 5/8", 1", 1 3/8 " — for maximum use of the string length.

The cases and peg boxes were given a finish of three thinned coats of satin varnish rubbed on with a cloth in the French polishing manner. This way the coats are touch dry very quickly, minimizing dust problems. Each coat rubs down the previous one and a final rub with a dry cloth gives a silky smooth, tactile grainy finish. The sound boards, bridges and sound post on the first harp were oiled with a mixture of lemon and orange essential oils giving a delightfully rich yet sharp aroma to complement the bright powerful treble sound. The second harp was oiled with lavender to match the bassy yet light sound.

The first performance of the treble harp was in September '84 by Peter Ferret using a backing tape of electronics and harp mixed together. This took place in the Liverpool Gallery exhibiting Hugonin's paintings. At this time it was strung in triplets with a tenor banjo bridge under each set. This was how I originally set it up in early '84 when I offered it to the artist as capable of playing his paintings. It wasn't until '92 that I was asked to make a second one. This, together with the first, was played in a series of gallery concerts by Matthew Gunn and Gilljan Carcas during 1993-1994. Then Andy Wilson and Ian Booth undertook to give some time to learning the techniques. That led to more gallery concerts in 1996-1997, a CD and part of a film score. At two of the concerts I gave a lecture explaining the relationship between the harps and the paintings, between sound and color, and the metaphysics of an aesthetic approach to structural engineering. Some of these ideas are in my illustrated booklet *The Natural Resonance of Structureless Form*.



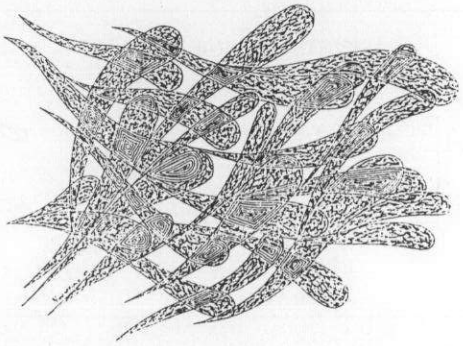
LEFT: Section through the pegbox, showing both types of peg

ABOVE: Section through the middle of the harp, showing tremolo action

RIGHT: Movable Bridge

BELOW: Components of the second stand, showing left and right front pieces (to the left), and left and right back pieces (to the right)

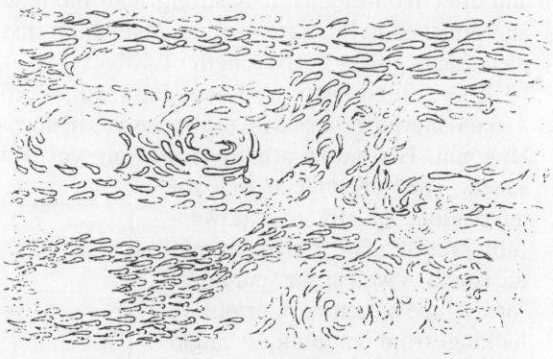
My current concerns are mainly aeronautical. I have finished an 85 sq.ft. musical kite that sounds similar to a porcelain wind chime. It is my intention to build several of these tuned to different pitches so that when walking across the downwind side of the kites varying chordal changes are heard. Further downwind the different sounds will blend to form an ethereal sonic environment that is shaped by the wind. I do have some timber maturing nicely to build a third harp and a six-string bass guitar with floating sound board. (Duane Eddy unplugged?) Both of these will be based on structural tension and have forms that are changeable, thus giving a greater range of effects. My basic aim is to set up maximum vibrations within the structure and use the inbuilt tension to amplify this and power it out into the surrounding space. Everything that diminishes the inherent qualities of the primary vibrating string has to be reduced, replaced or preferably discarded. Metal tends to act as a sound sink. Glues, varnishes and oils act as filters and can be used to shape qualities within the root sound. The newly available harp strings are brighter, richer sounding and less squeaky when played. A pre-curved soundboard resists or stores greater tension than a flat one. The underside can be carved out to lighten it and increase the sculptural complexity of the acoustic volume.

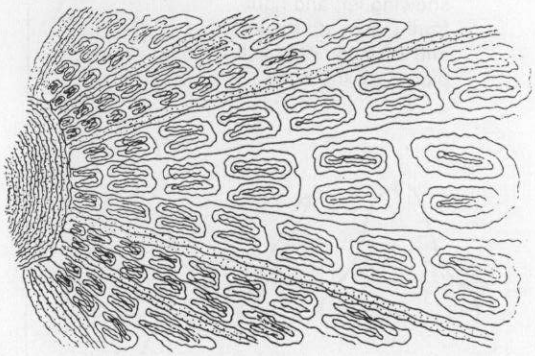


If a conventional guitar box were to be filled with foam, then after removing the wood the remaining core would have imprinted on it all the acoustic complexities of the interior space — the kerfed linings, soundboard fan braces, back braces, end blocks, bridge pins, jack plug etc. If this technique were applied to violins, lutes, trumpets, clarinets, ocarinas or Pan pipes, then one would be able to see and literally feel the shape of the sound produced. These cores could then be analyzed for their own specific combinations of curves, lines, and forms. Soon a basic vocabulary of shape becomes apparent. These understandings are the roots of my sound drawings. From this perspective, that most complex of acoustic instruments, the piano, has a truly messy and very boring acoustic chamber. A flat box full of metal bits. Similarly, the zither and autoharp are mean and narrow, the saxophone sinuous and generous, the lute is nicely rounded and the clarinet thin and piercing. It is also useful to see concert halls, cathedrals, rooms full of people, alleyways or canyons in this way. Ideally the outer performing acoustic space will match the inner space of the instruments.

There is a lot of scope here for the designers of stage sets used by gigging acoustic musicians to produce a portable, collapsible "Hollywood Bowl" that will direct and shape the sound in a structured way. The design and engineering of kites and tents is a useful starting point to begin building lightweight, strong and portable structures. Many modern materials have a shiny, acoustically reflective surface. My previous experience as a set designer for a mobile urban theater group in Newcastle on Tyne proved that such structures can take a substantial amount of abuse, being thrown in an out of vans several times a day.

As a general principle I've found that the more flexible a structure is, the more fulsome is its appeal. Of course to be specific about such functional considerations requires a vocabulary that encompasses both scientific and aesthetic understandings. Words very rarely do this. I feel that developing a visual vocabulary to discuss these areas of thought is important. It will allow us to move away from linear and geometrically run thought processes. Words are like numbers in that they are precisely defined units of information. To use them as a basis for an aesthetic vocabulary is to limit our expression. For instance, is the golden proportion of 1.6:1 really so perfect and beautiful? Why didn't the rectangular violin or guitar catch on? They are easy to manufacture and therefore reasonably priced, yet they just don't sound as good. Archtop guitars sound richer than flat tops, yet how would we describe those qualities which make an instrument special? Numbers allow us to duplicate structural forms exactly but do not guarantee that extra something. Words are not necessarily meaningful to those who don't speak the language. However, the graphic, artistic and visual mode of expression is comprehensible to all. Just as geographical, marine and stellar cartographers have a wealth of symbols at their disposal, so too should acousticians; otherwise we run the risk of endlessly repeating variations on a theme or worse, descending into a Helmholtzian hell hole of numerological nonsensicality.



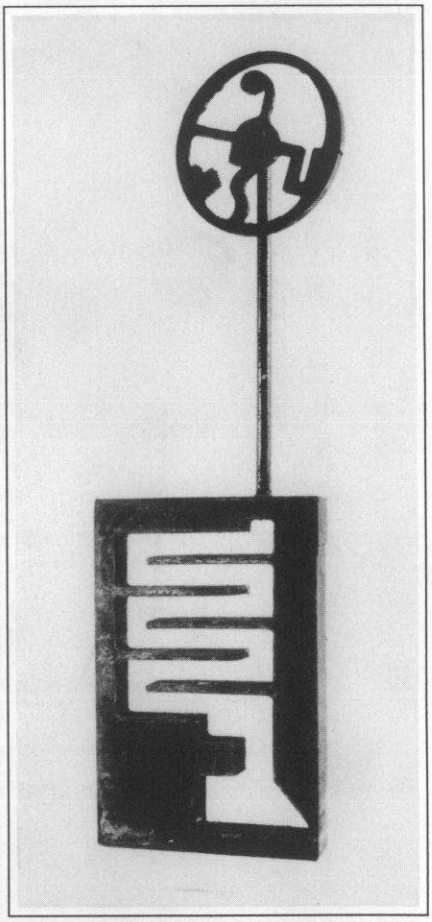


Peter Horsefield is 51, has travelled extensively and is now embarking on a two-year course of study specializing in horticultural and environmental conservation. A long term aim is the planting of musical instrument timber. As well as the design of stringed instruments his other intellectual preoccupation is the design and fabrication of acrobatic glider-kites. Copies of his illustrated booklet "The Natural Resonance of Structureless Form" (which discusses the visual representation of sound and wind) can be obtained for $10 from 12, Sunset Rise, Meanwood, Leeds LS6 4LN, U.K. (Phone 0113 - 2789258 within England; outside England include appropriate international codes).

SOUND SCUPTURE FROM HUNGARY

Photographs of works by Rezsö Móder and Tibor Budahelyi

Notes by Kim Johnson



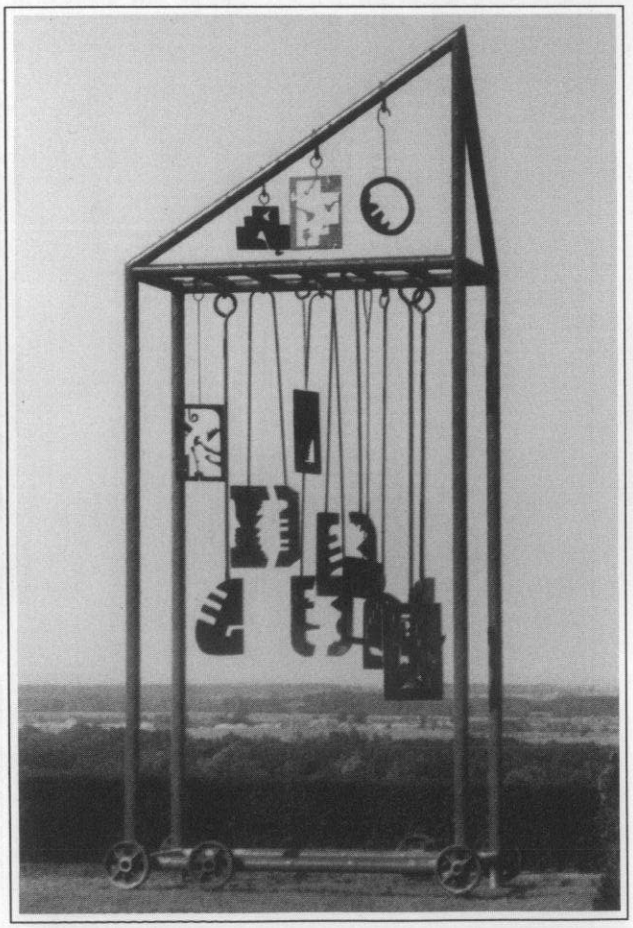
Steel mobile sounding sculpture from the *Time Axes* series by Rezsö Móder

Albert Leskowsky, whose wonderful instrument collection was seen in *EMI* Vol. 11 #2, has sent along exhibit catalogs on the work of two Hungarian sculptors, and we have obtained permission to reproduce some of the photos here.

Rezsö Móder and Tibor Budahelyi are artists who integrate the industrial and the musical in their work. Rezsö Móder's powerful sculptures were forged from ironwork traditions of the central Hungarian city of Dunaújváros. Tibor Budahelyi grew up in Budapest and worked for over two decades as a locksmith and mechanic. His art developed out of and is defined by the industrial environment of his trade.

The volume devoted to Móder from which these photos were taken, called *Time Axis* (published by the Palace of Exhibitions, Budapest, 1991), is a collection of mostly black-and-white photographs of his art with brief reviews by artists and critics. Móder's iron sculptures are heavy, industrial, yet even in these photographs are touched by an unexpected fluidity and grace. László Beke, in his introductory remarks, describes Móder as "an artisan...cultivating Central-European poverty-stricken utopias with ribald humor." Describing his performance piece "Bartok in the ironworks," Beke writes, Móder "...hammers iron sculptures...as [if] he could not separate himself from the sound of ironworks — [he] beats the ear drum of the audience." The critic Gábor Pataki sees the work as simultaneously being utopian and realistic; "music for sheet-iron, weekdays and utopia, illusions and hope."

Rezsö Móder's *Rolling Cosmos*, sounding steel construction.

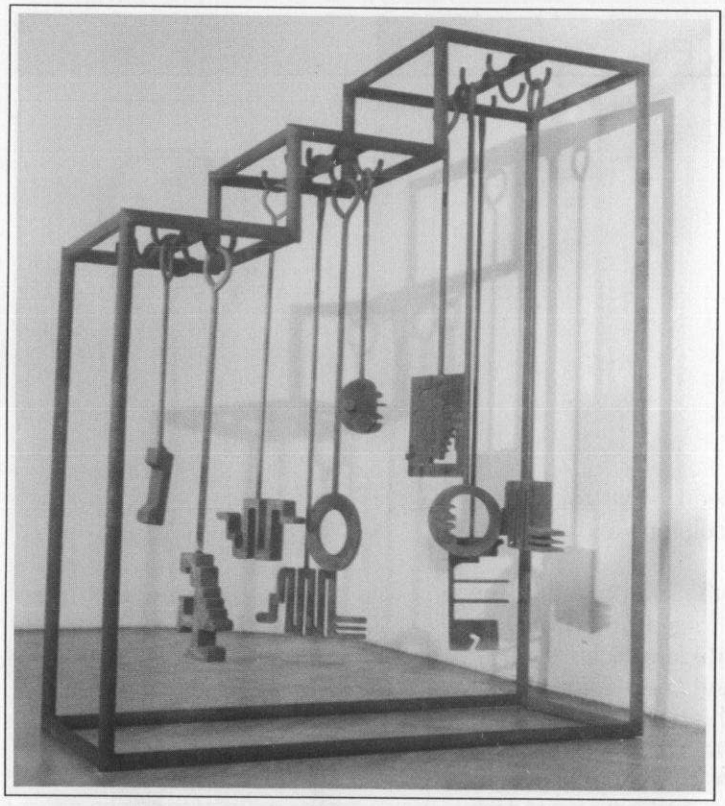


Budahelyi, the title of the catalog dedicated to the medals and statues of Tibor Budahelyi (no publisher is given), is a beautifully produced volume. As in *Time Axis,* artists and critics provide commentary on his art and development of his art over the course of his career.

Some of Budahelyi's works involve sound directly — metal and wooden forms played as sound sources — while others evoke sound in a metaphorical sense, as visual forms expressive of qualities associated with sound. Frank János describes an exhibition at the Impre Gaál Gallery in Pestszenterzsébet (1984) in which Budahelyi "assembled a suite from the sounds [made by such pieces as *Alto* and *Sound-Transmitter* I] and played it as background music ... He followed up with large wooden platters — partly natural, partly brightly colored — which could be played like xylophones." Anna Baranyi writes "The richness of musical associations are primarily embodied in his medals, with which he contributed considerably Hungarian and European metallic art...The sound — the instrumental option — gives his work a whole new dimension, a chance for further creative possibilities, beside the visual experience."

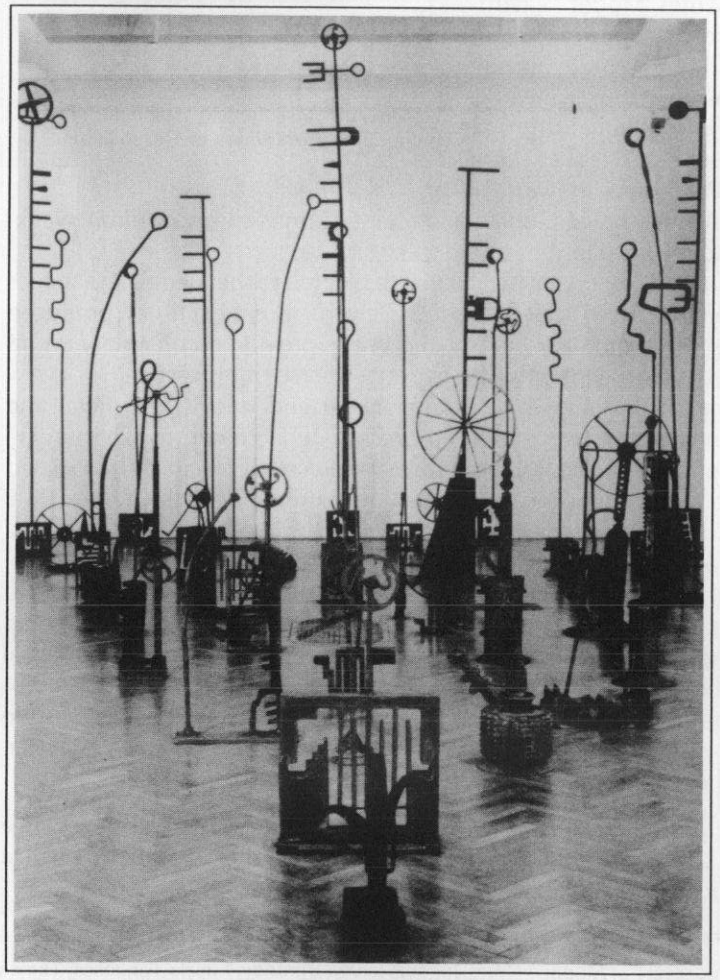
We present here selected photographs of Rezsö Móder's evocative sound sculptures along with photographs of Tibor Budahelyi's lyrical constructions in metal and wood.

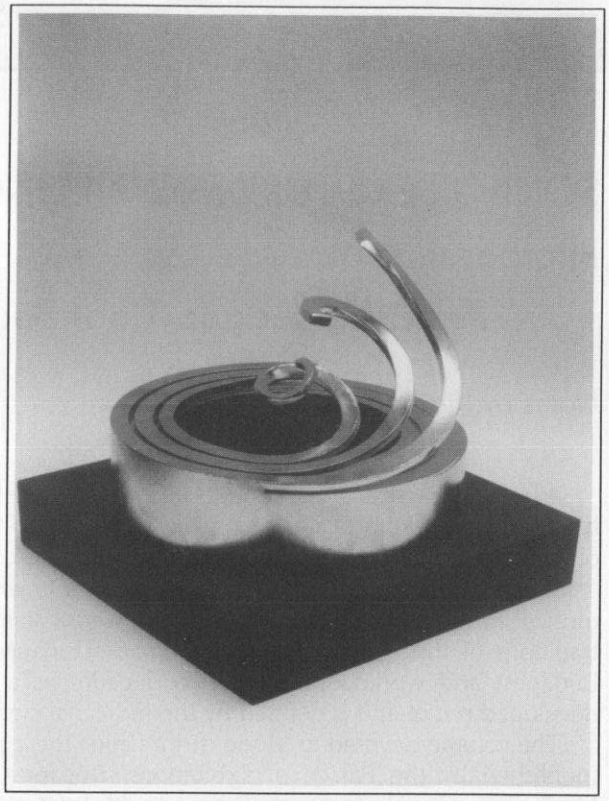
Photographers: For Móder — Imre Juhász, István Bárándy, Laszló Tengölics, Tamás Somogyi. For Budahelyi — Imre Juhász



Above: *Cosmos Stairs*, mobile steel construction by Rezsö Móder.

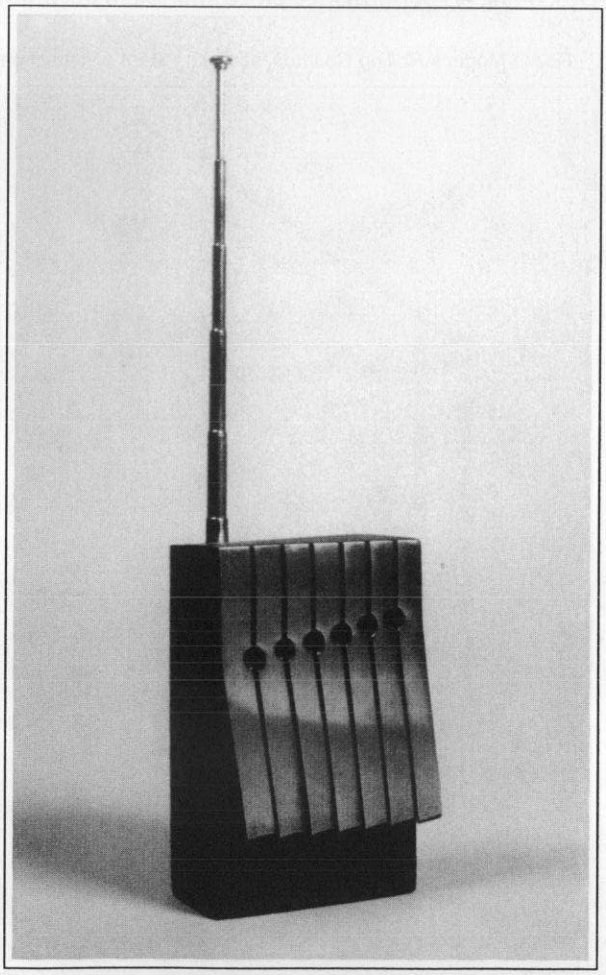
Below: Móder's *Time Axes* -- 40 music-making mobile steel constructions.

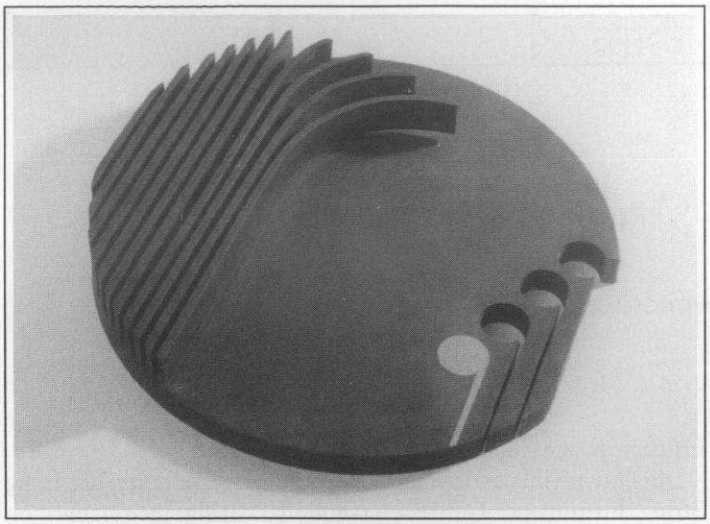


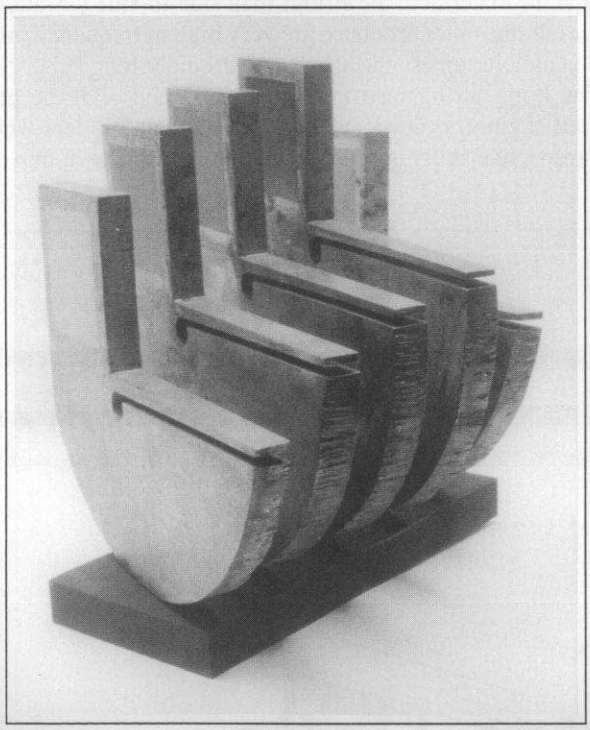


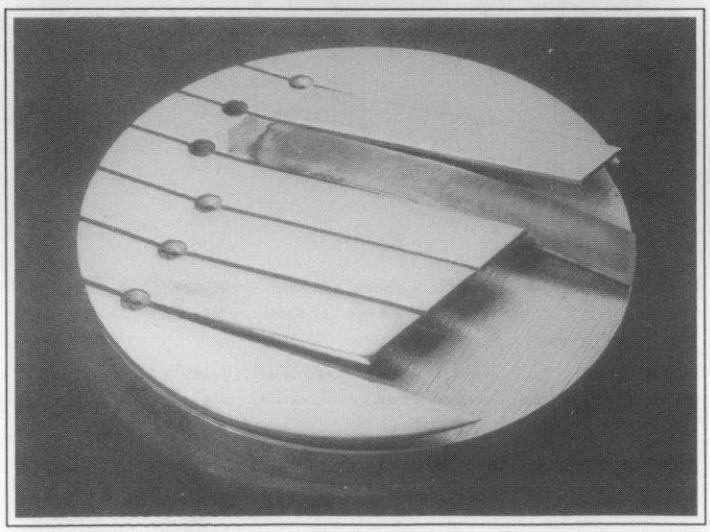
Above: Tibor Budahelyi's *Bunchy Sound* (chromium steel)

Below: *Sound Transmitter I* (chemically browned steel) by Tibor Budahelyi









Top: Tibor Budahelyi's *Plucked Sound* (bronze)
Center: *Voice of Kassák* (steel)
Bottom: *Alto* (steel)

ELLEN FULLMAN'S LONG STRING INSTRUMENT

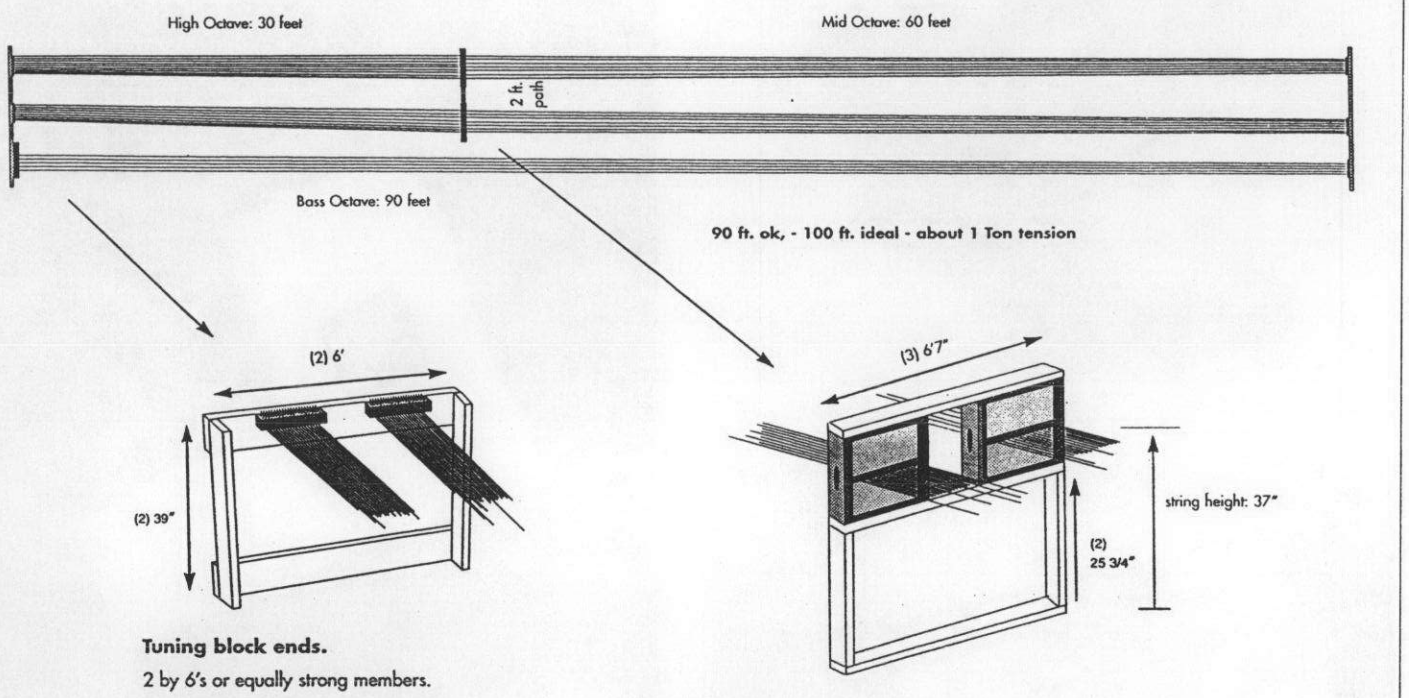
By Mike Hovancsek

Ellen Fullman is an artist who has devoted the last two decades of her life to sound-producing art. She was originally featured in the pages of *EMI* in Vol. 1 #2 (Aug. '85). Since then, Ellen has worked to refine her instruments, her compositions, and her playing style. Most recently, Periplum has released a CD of her work with The Deep Listening Band entitled *Suspended Music*.

Ellen began experimenting with sound art when she created her metal skirt. This particular piece is a skirt made of metal that has guitar strings stretching from the edge of the skirt to the tip and heel of the wearer's shoes. Contact mics attached to this unique outfit amplify the sounds on a small amp that is carried like a purse. When the wearer struggles to walk in the restrictive instrument, a cacophony of sounds is produced.

Following this experiment, Ellen began developing her Long String Instrument. Unlike conventional string instruments on which sound is produced with side-to-side vibration of the string, the Long String Instrument produces sound with vibrations that travel from end to end of the string. These vibrations travel far faster in the material of the strings than side-to-side vibrations do. As a result, the tones produced are very high in frequency, making them inaudible, unless the string is extremely long.

The Long String Instrument was designed with the help of assorted engineers, musicians, and instrument builders who lent their respective skills in order to make the instrument maximally



INSTALLATION DIAGRAM FOR THE LONG STRING INSTRUMENT

RIGHT: A view of the entire Long String Instrument installation for Pat Graney's "Movement Meditation Project," Magnuson Park, Seattle, July 1996.

Photos by Ellen Fullman

effective in producing sound. The most recent version is made up of 120 80-foot-long strings that are suspended at waist height, stretching from a wall to a large resonator box. Since length (but not tension) of each string determines the pitch, a C clamp is attached to each string for tuning purposes. (The mass of the clamp is enough to define an end point to the effective vibrating length of the string segment, so tuning can be done by attaching the clamp at different points.)

Ellen and her musicians play the instrument by rubbing rosined fingers along the length of the strings in much the same way that a person plays wine glasses by rubbing the edge of the glass. Because of the length of the strings, long tones can be produced without interruption. As soon as the friction ceases, so does the tone. Multiple musicians can play the instrument at one time, numbered lines on the floor indicating where each performer needs to walk at various points in any given composition.

The Long String Instrument is tuned in just intonation because of its resonant qualities. Proportionate ratios in the string lengths and resulting frequencies (2:1, 3:2, 4:3, 5:4, etc...) produce a wide range of secondary pitches, the overtones creating a complex, multi-layered harmonic texture.

The notation system used for Ellen's Long-String Instrument evolved over the years as the instrument itself evolved. Reflecting

LEFT: Nigel Jacobs and Elise Gould perform on the double-sided resonators. The score is mounted above.

numerous qualities of sound that can't be represented with standard Western notation, this system corresponds with the markings on the floor that indicate where the performer stands during various points in the composition. It also indicates specific pitches and textures that would appear in a piece.

So much for a technical description of Ellen's instruments and compositions. To give readers an idea of what her music actually *sounds* like, I will quote from a short interview I conducted with her recently:

Mike Hovancsek: How do you describe your music?

Ellen Fullman: All I can describe is what I am interested in, which may not be a description of the music itself. In other words, the music is an artifact left over from the journey; the search. What I have been interested in in recent pieces is to be in a landscape — a mood — and to explore the moods of various pitch relationships in just intonation. It is important to me to listen on different levels, to make sound with depth — multiple layers of things to listen to and to become aware of — by listening in different ways.

Lately, I have been restringing and tuning my instrument down from the Key of C to the key of A. A is the key for the female voice in Indian music. I have been studying North Indian vocal music for the past four years. I plan to make a piece using the instrument as a sound source on tape to sing with. I will produce all the sound myself — layering tracks — and explore digital editing as an instrument in and of itself.

MH: Describe how your long string instrument is played and what it sounds like.

EF: My studio is a warehouse filled with about 150 strings running wall to wall. These are arranged with aisles in which performers walk, playing with both hands, strings on either side. The strings are played with rosin-coated fingers, rubbing the wires lengthwise, the performers' hands becoming the "bow." The sound-associations with traditional instruments vary, depending on which octave and on how many strings are being played. The high octave can sound like a harmonica. The mid octave can have a cello-like sound. The bass octave, like a bowed bass.

With such a rich presence of overtones, the overall effect with three performers is pipe organ-like in its massiveness. Percussive rhythmic playing is done with the palm of the hand brushing against groupings of strings tuned to chords. Another method of sound production uses rosin-coated fishing line, wrapped around the string and dragged along the length. This produces an almost mandolin-like rapid plucking.

Ellen Fullman's music can be found on Body Music *(XI: P.O. Box 1754, Canal St. Station, New York, NY. 10013) and* Suspended Music *(Periplum: P.O. Box 95678, Seattle, WA 98145).* Change of Direction *will also be available soon from New Albion. Ellen can be reached at PO Box 23347, Seattle, WA 98102*

RAMBLINGS

By Bart Hopkin

Today's subject: Occam's Razor.

A few years ago I came up with a homebuildable design for a simple harp. It was relatively easy and inexpensive to make, and the resulting instrument had an attractive tone and decent volume. Some time later, encouraged by that success, I started thinking about further developing the design. But my attempts at improvement proved ill-conceived. Ill-conceived improvement, and what's to be learned from the experience, is what I'll be talking about in this column.

The homebuildable harp used a roasting pan as a ready-made sound chamber, covered with a 1/8" plywood soundboard. The strings were attached in a special way that served to pulled the whole instrument together securely. This made for a strong and stable instrument requiring no glue and no fancy joinery. The original design is included in my book *Making Simple Instruments*, and if you're interested you can see it in detail there.

My ideas for improving the little harp were mostly about adding more strings to increase the range and musical versatility. (The original had just 12 strings, tuned diatonically.) The more I thought about the possibilities, the more ambitious I got: soon I was not only planning for more strings; I was speculating about adding them in multiple planes, to allow me to explore some unusual pitch layouts in the relationships between the rows of strings. This line of thought led me first to a cross-strung* design with two rows of strings, and then to the notion — don't laugh — of a *double* cross-strung arrangement with four.

So I went out and purchased the next size bigger roasting pan, and set to work. The successor to the original, simple harp was to be a fantastic, 56-string, double cross-strung harp, entirely built around a $10 roasting pan. As I've been saying, the underlying design was pretty simple, and so the construction was not too difficult. But stringing it up and tuning it (to a rather elaborate set of pitch-arrays that I had worked up) proved to be quite a chore.

Experienced harp makers will have foreseen where all this is leading. Despite what I thought were my foresightful efforts to reinforce the whole structure to take the much increased tension, the stress of the 56 strings was too great. Over a period of weeks, as I tried to bring the instrument up to pitch, the pan gradually

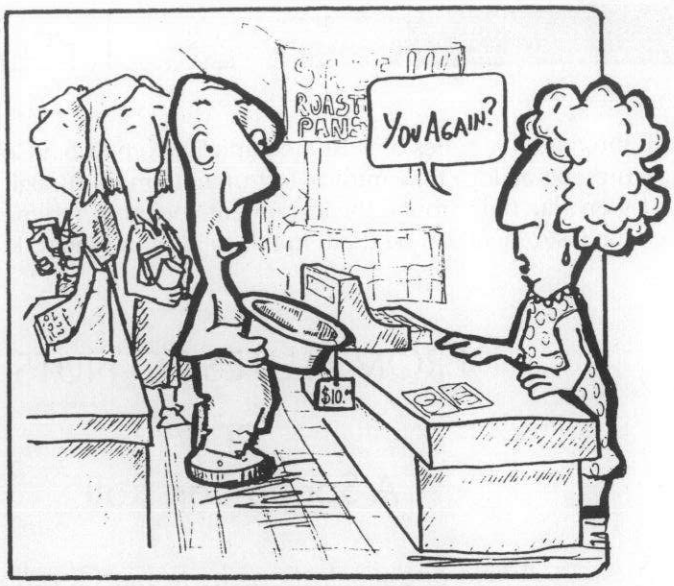
*Cross-strung harps are harps in which there are two sets of strings, arrayed in two intersecting planes, with the strings passing between each other at the crossing of the two planes. With this arrangement, each of the player's hands has access to both sets of strings. Cross stringing is most often used to make a full complement of twelve tones per octave available to the player without sacrificing the familiar diatonic tuning within each row. Cross stringing could as well be used to facilitate any number of other tunings or pitch arrays. If the number of references in recent issues of the *Folk Harp Journal* is any indication, the last few years have seen an increase in interest in cross-strung harps.

collapsed. Several other technical and structural problems appeared in the finished instrument as well, mostly relating to the complexity of the stringing configuration ... but I'll spare you the boring details.

And yet these disappointments are not the really bad part of this story. After all, I probably could have gotten a new pan, done a really thorough job of reinforcing, repeated the stringing process and come up with a workable instrument. The really bad part is: even in those transitory moments when I got the instrument roughly in tune ... *it was no fun to play!* The whole thing, with its elaborate string layout, seemed awkward, un-ergonomic, un-intuitive, un-spirited and un-musical; a far cry from the lovely, friendly feel and sound of the simple roasting pan harp that had come before.

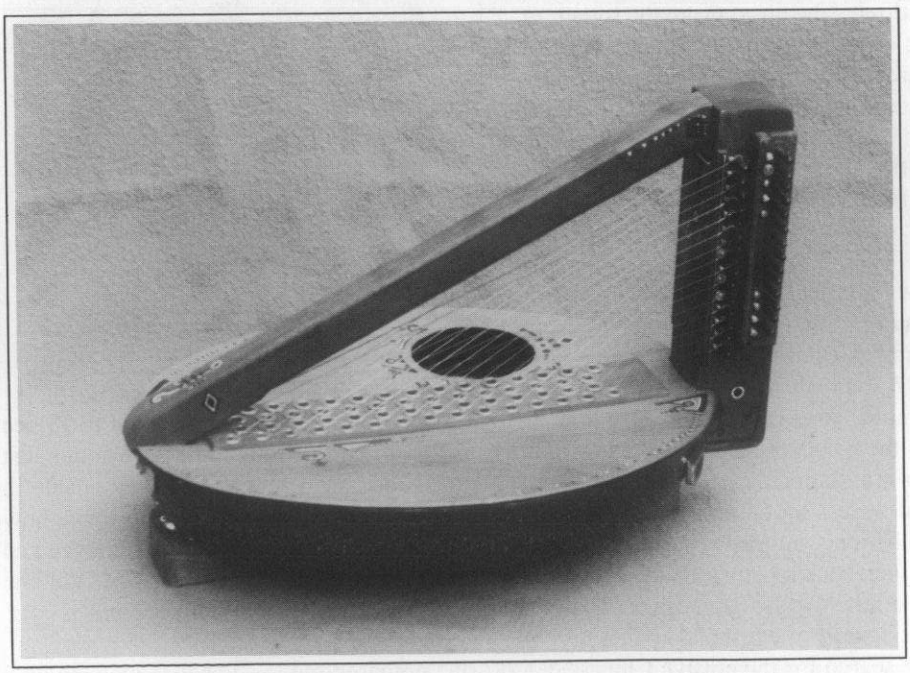
This brings us to Occam's Razor. William of Occam (1280 – 1349) was an English biblical scholar and philosopher who made the courageous mistake of disagreeing with Pope John XXII on certain fine points of theology, and spent several years confined to his monastery as a result. Rock 'em Sock 'em Occam, as he was popularly known during his hey-day, is now remembered primarily as the author of the famous dictum referred to as Occam's Razor, which reads "*entia non sunt multiplicanda praeter necessitatem.*" This translates literally as "beings ought not be multiplied beyond necessity." In modern times it has often been interpreted as meaning something along the lines of "keep it simple, stupid." Occam's razor has recently been the subject of an ongoing series of debates in the always-erudite and always-contentious *FoMRHI Quarterly* (the journal of the Fellowship of Makers and Restorers of Historical Instruments). An instrument makers' journal such as *FoMRHI* may seem an improbable forum for a discussion of 14th century religious philosophy, but there it is, and here it is now in *EMI* as well.

My unsuccessful double cross-strung roasting pan harp is, for me, a classic illustration of the importance of this dictum. What on earth possessed me to want to put 56 strings on a 15-inch roasting pan? This is a problem that sometimes arises when musical instrument design begins to lean toward mechanistic



solutions. Music is not about machinery. The musical instruments that sing most willingly, that display the most generous musical spirit, are those in which some essential musical personality is discovered, and is given free play. When the maker starts *multiplicand*ing too many *entia*s, the intended enhancements are just as likely to add up to an encumbrance.

So I went back to the same store and purchased yet another roasting pan. I took the forepillar, arm and soundboard from the now-defunct double cross-strung harp and mounted them on the new pan, being careful to reinforce the pan extra-generously at critical points. But this time I put on just half as many strings. The result is a simpler cross-strung harp. It's more elaborate than the single-strung instrument that started this whole episode, but quite a bit friendlier than the ill-fated double cross-strung; in fact, it's actually pleasant to play. You can see it, complete with its rows of now-unused tuning pins and grommetted soundboard holes, in the accompanying photograph.



This is the third in a series of illustrated articles from Robin Goodfellow now appearing in *Experimental Musical Instruments*. Each article presents an idea for a musical instrument simple enough to be made by children. In addition, each contains the raw material for a lesson plan built around the instrument, including rudimentary principles of sound, elements of cultural lore, and a song with which the instrument can be used. In this third in the series, Robin presents ideas for vessel flutes.

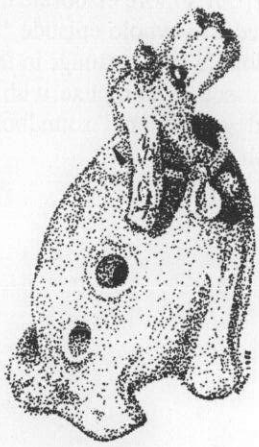
FROM FLUTES TO NUTS
or
A Spring Egg Roll

Article and illustrations by Robin Goodfellow

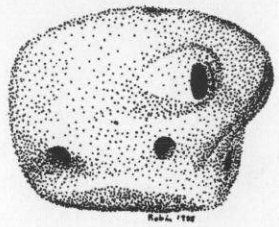
Computer engineers have adopted food-related words into menus of bits, nibbles of bytes, chunks of apples (Macintoshes, of course), and even Pizzas and Java beans to communicate the new concepts and products they were creating.

Musicians have had a more direct connection to the food world. Nut shells have been used as whistles on arrow shafts in Peru, and coconut shells are reported to have been used as voice masks and ocarinas in Africa. There are references to carrots and turnips being hollowed out and blown across to produce a tone. Even beeswax and bones have been used to make blown instruments.

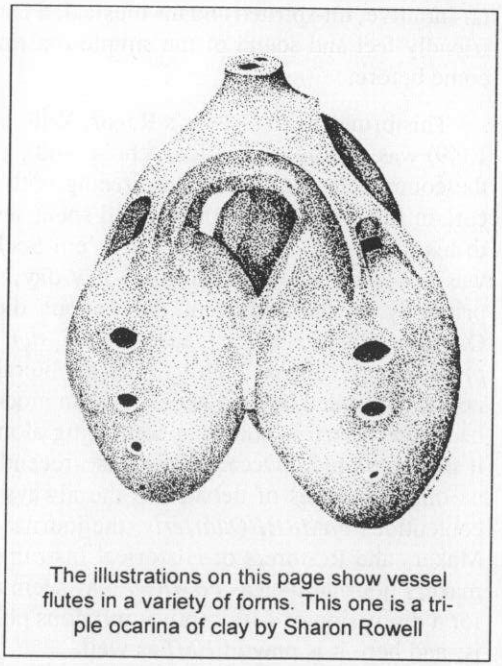
The subject of this article, however, is eggshells and what can be done with them after the egg has left. When properly blown out, the yolk is pretty well mixed up with the white and is suitable for egg flower soup, or scrambled eggs. What is left is a vessel of excellent size and shape to form an ocarina.



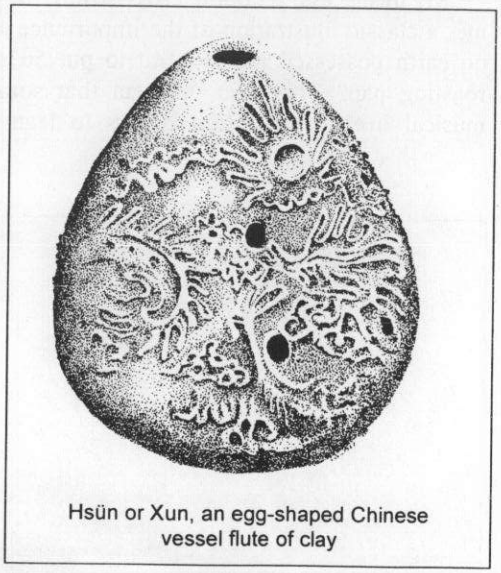
The author's own "Good Dog" ocarina of clay



A pre-Columbian ocarina



The illustrations on this page show vessel flutes in a variety of forms. This one is a triple ocarina of clay by Sharon Rowell



Hsün or Xun, an egg-shaped Chinese vessel flute of clay

An ocarina is technically an enclosed chamber in which air vibrates when an air stream is blown across the edge of an opening in the chamber. Ocarinas are generally either fippled or cross blown. That is, either the player's embouchure (mouth shape) directs the air to make the sound, or there is a duct or channel, called the fipple, that puts the air stream in the right place to make a sound. This article concerns ductless, or cross-blown ocarinas.

The connection between birds eggs and ocarinas is something I read about years ago in *The History of Musical Instruments* by Curt Sachs (New York: W.W. Norton Co., 1940). I tracked down his source, *Musical References in the Chinese Classics* by a Walter Kaufman (reprinted in Monographs in Musicology Number 5, Information Coordinators Inc., Detroit 1976), in which the idea of using two bird's eggs as molds for ocarinas, one of an inner, one for an outer mold, is attributed to Prince Chu Tsai-yu, as the whole thing was presented by a Mister Moule. Something must have gotten lost in the numerous translations, because when I tried this technique, which sounds so reasonable in print, what I got were a lot of cracked clay pieces as the clay dried and shrank. I don't know how this was originally done, unless the wet clay was cut, the egg (hardboiled, I hope) was removed and the clay pieces stuck back together again. I was very grateful when Sharon Rowell (see *EMI* Volume 1, #2.) taught me how to make an ocarina from a hollow clay egg shape by joining two pinch pots! (All this without benefit of eggshells at all!)

Anyway, the search for the elusive Chinese egg ocarina prepared me for a chance meeting on a

houseboat in the Sausalito harbor when I saw a large eggshell elaborately decorated as a Christmas ornament. Its playability was quickly ascertained and I had a new instrument to offer my students.

After a few years and wiping innumerable raw eggs from the floor, I have developed a technique for teaching children how to blow their own eggs. Not all children are able to play them instantly, but most kids can get a sound with a bit of practice.

Here is the technique I developed for teaching a classroom of kids to make a one-note eggshell ocarina:

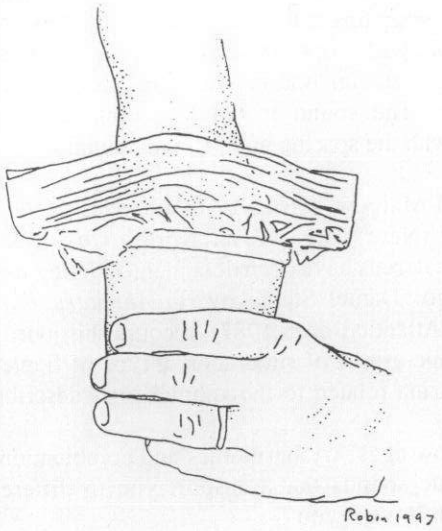
Give each child a small zipper-closed plastic bag, a paper or plastic drinking cup, a large safety pin, a sticky label or a Sharpie pen (they write on plastic) and later, when the students are prepared, the raw egg.

The student puts her name on the plastic bag by writing with the Sharpie or using the label. She then places her hand in the bag, opens it up and puts it in the cup, pulling the edges down around the outside of the cup and keeping an indented "nest" as deep as possible to receive the contents of the egg.

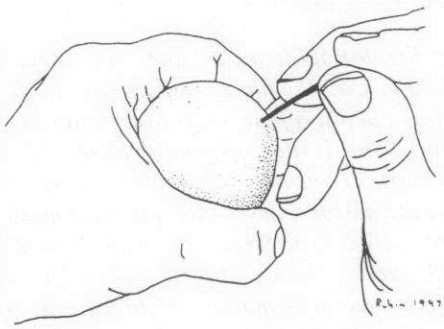
When this is in place, I demonstrate the technique by stabbing the egg on one end with the safety pin. This is difficult for some children because the egg must be held very gently with one hand while at the same time applying quite a lot of pressure on the eggshell with the other. Children frequently tense up and apply pressure with both hands at once. I always bring extra eggs and a roll of paper towels.

The idea here is to make a very small hole in one end of the egg and a slightly larger, dime-size or smaller aperture in the other. Place lips firmly to the small hole, put the egg directly above the cup with the plastic bag and blow like crazy. If successful, first clear, then yellow egg innards ooze into the cup. Children usually find this intensely disgusting. I have not yet found a child who refused the project on these grounds, however.

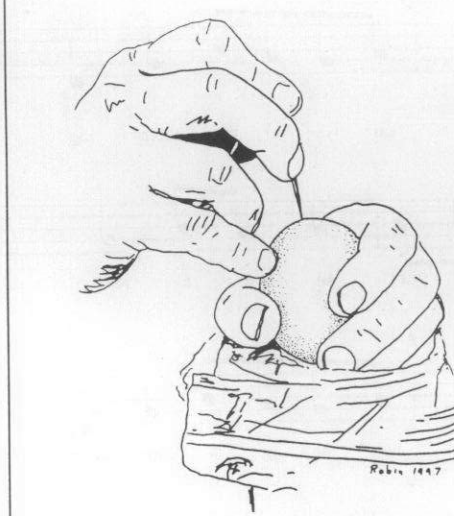
The bag may now be secured and the egg cooked for lunch. I can't recommend taking the egg home in the bag unless there is going to be a very short travel time because of salmonella dangers. With the egg properly disposed of, we may return



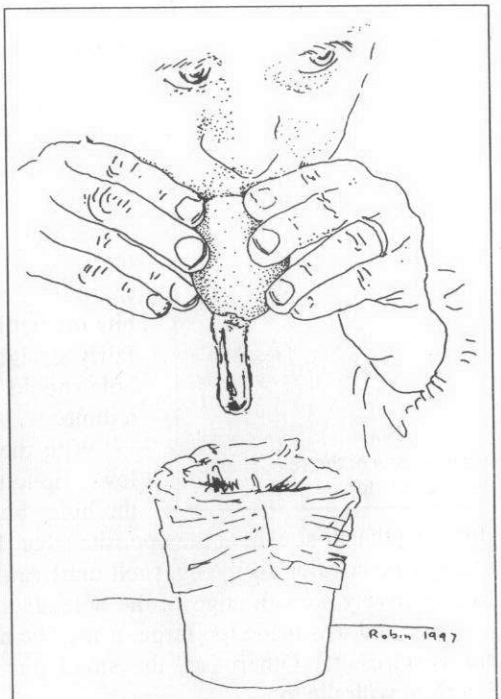
1. Making a nest for the egg. Push plastic zipper bag deep into cup



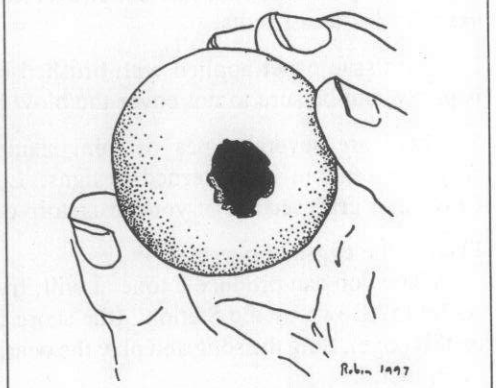
2. Pierce one end of egg with safety pin. Small pin hole is enough.



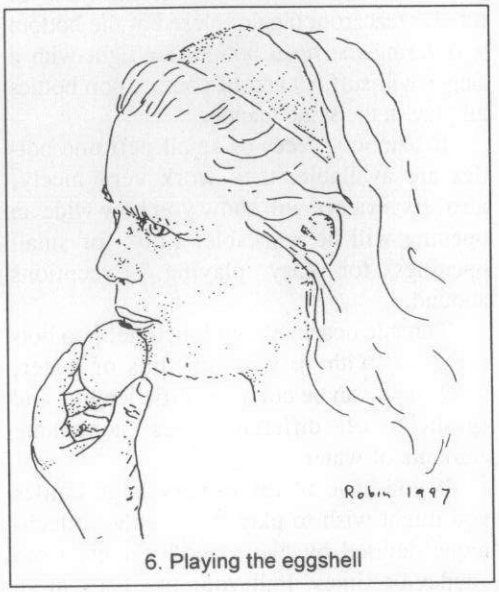
3. Pierce the other end. Peel back a small portion of eggshell to make a small hole.



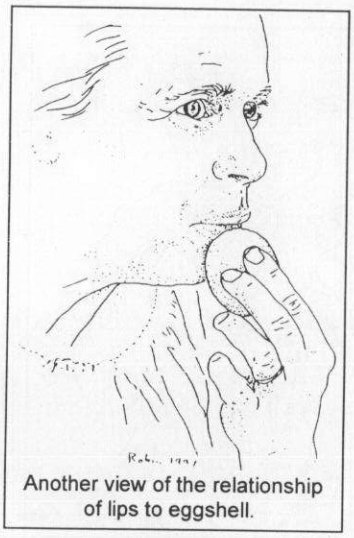
4. Blow *hard* through pinhole. Egg will exit through larger hole.



5. Remove membrane, if any. Rinse with water by filling and shaking or blowing water out.



6. Playing the eggshell



Another view of the relationship of lips to eggshell.

to the shell. First, rinse in warm, soapy water to remove remnants of yolk. The water can be shaken out of the larger of the two holes, or if stuck, blow again to remove remaining water. If a thin membrane is found around the larger hole, gently pull it off, leaving the edge of the hole clean and sharp. If the hole is jagged, pick bits off until at least one side is fairly straight and smooth. This hole should be about the size of a dime.

With the bottom line of the lower lip touching a place below the hole, blow across the hole, directing the air stream at the opposite edge. If there is no sound, change the position of the eggshell until you are blowing across to a relatively smooth edge of the hole. If the small hole at the opposite end was made too large, it may be necessary to cover it for best results. Otherwise, the small pin hole seems not to interfere with the tone.

Eggshell ocarinas may be decorated with a variety of techniques. A few to try are:

1. Sharpie pens work on just about everything. Have the shells very dry for best results.

2. Torn tissue paper applied with brushed-on diluted white glue is pretty, but be sure to not cover the blow hole!

3. There are several types of mini stamp-pens available for stamping random or patterned designs. Look for them in the Crayola or craft section of your drugstore or grocery store.

Playing the eggshell ocarinas:

When you can produce a tone at will, try adding the "whoo" sound to "Down by the Station" (the score for this song appears on this page). Sing the song and play the ocarina instead of singing "toot toot."

The ocarina or vessel flute principle is easily extended to other found instruments. Pen caps, large diameter straws cut in lengths and closed at the bottom, certain types of tubular macaroni (again, closed at the bottom – covering the open bottom air tight with a finger will suffice) and of course, pop bottles all play in the same manner.

If bamboo pieces or small perfume bottles are available, they work very nicely, also. Experience will show you how wide an opening will be workable. Look for small openings for easy playing. Exceptions abound.

Tunable ocarinas could include: pop bottles filled with varying amounts of water, straws that can be cut to specific lengths and eggshells of different sizes containing amounts of water.

If you have access to very large bottles you might wish to play them with the technique devised by "jug band" players from vaudeville times. Pull your lips back in an exaggerated "M" and let them out with an explosive "P". Use a lot of force and place your lips a few inches directly above the hole in the bottle. This will work sometimes with other wider mouthed jars, such as ketchup bottles, that will not sound if directly blown across. The sound is not loud, but deep and resonant. Experiment with the spacing and "P" sound until you get the bottle to resonate.

According to Sibyl Marcuse's *Musical Instruments: A Comprehensive Dictionary* (New York: W.W. Norton Co., 1964), vessel flutes of many materials have been documented dating from thousands of years ago. Daniel Statnekov, in *Animated Earth* (Berkeley, CA: North Atlantic Books 1987), recounts his journey to rediscover a shamanic aspect of silberados, a type of fippled, double-chambered ocarina related to the simpler ones described in this article.

So find vessels, blow eggs, try harmonies and combinations. If you happen to create sounds that transport you to different worlds, don't say I didn't warn you !

Bon voyage and bon appetit!

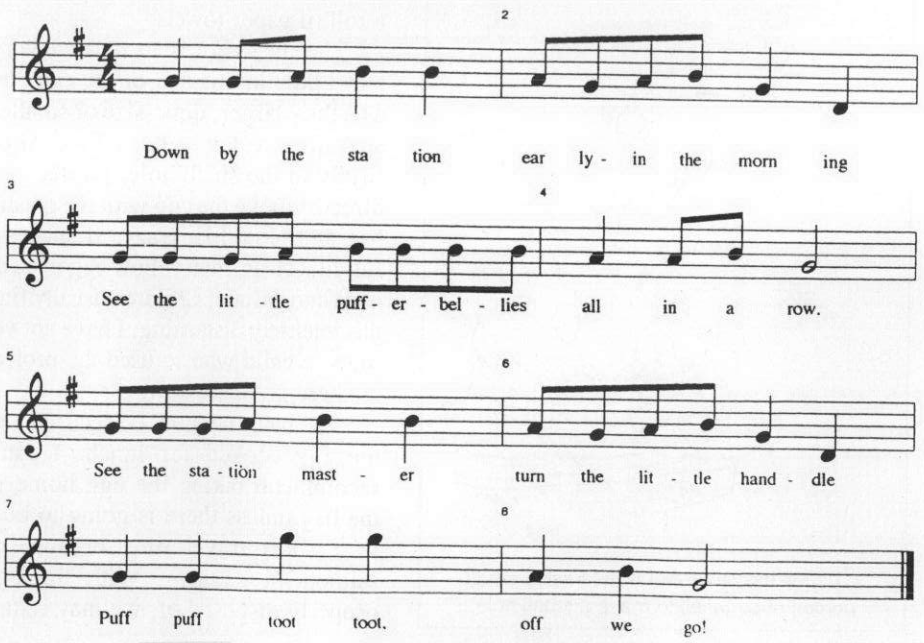
ROBIN RECOMMENDS:

For more information on vessel flutes and a variety of other instruments, an excellent source is Karl Gustav Izikowitz: *Musical and other sound Instruments of the South American Indians: A Comparative Ethnographical Study* (Goteborgs Kungl Vetenskaps-och Vitterhets-samhalles Handlingar).

Robin Goodfellow is the director of Mandala Fluteworks, a studio of music and art in Oakland, CA. She has been teaching children and adults for many years, and plays flute, piccolo and tin whistle among other instruments. She is the original founder of the Queen's Ha'Penny Consort, a recorder and early instrument group that specializes in the performance of Renaissance music.

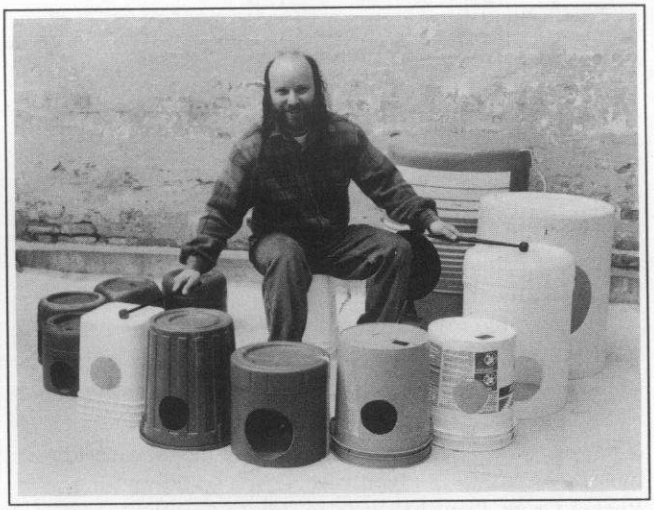
Robin can be reached at 1655 Vista Street, Oakland CA 94602, by phone (510)530-7835 or by email robingoodfellow@earthling.net. She would appreciate information about stories and legends of instruments, and ideas readers may have for simple instruments suitable for children to make and play.

Down by the Station



BUCKET DRUM TOMS and the MARCHING MARIMBA

by Jody Kruskal



For twelve years I have been writing works for parades, dance, theater, and concert productions to be played on the instruments of the Public Works Orchestra. I've built most of the instruments in the orchestra, and shamelessly appropriate interesting new ideas from wherever I find them — including the pages of *Experimental Musical Instruments* magazine. After years of taking, it's time to give a little, so here are two new additions to the Public Works Orchestra instrument collection that I would like to share with other readers.

I have long admired the rich tonal qualities of the empty compound bucket. These plastic (approximately 5 1/2 gallons) containers are available at most construction sites and can be found in dumpsters nationwide. If you hold one between your knees and strike the bottom hard with a yarn-headed mallet, the resulting sound is a low, forceful thud having a definite single pitch with a quick decay. This drum is quite satisfying and dynamically responsive, ranging from an intimate tap to a heavy blow that can be felt in your gut.

Photo #1 (this page, upper right): Bucket Drum Toms, pitches from low to high: G,D,G,A,B,C,D,E,F#,G,A,B. [See the front cover for a larger print of this photo.]

Photo #2 (directly above):Used plastic containers from 50 gallons to a few ounces are all likely suspects. My biggest ones formerly contained sweeping compound or soap. Sources may include commercial bakeries and other food service operations, building construction and renovation sites, curbside recycling or transfer stations

Bucket drums are not true membranophones because the bottom membrane has not been stretched over the sides, but rather cast all of a piece. However they operate in much the same way. By contrast with most drums, the sides of the musical bucket are the same thickness and material as its head. The three-dimensional curvature of the sides give them a shape that is much more rigid than the flat disc-like bottom. The difference in rigidity allows the bottom of the bucket to vibrate in relative isolation from the sides, making it a fine membrane for these durable drums. The pitch that the bucket drum produces can be tuned up or down (I'll explain how later in this article) allowing for a collection of tuned drums to work together as a pitched percussion instrument. After a year of collecting and experimenting with various plastic containers, I've come up with a twelve-note instrument that grows with each new find. (see photos #1 and #2)

I am hardly the first musician to use the compound bucket. My colleague Skip La Plante (co-founder of the group Music for Homemade Instruments here in New York City) tells of hearing large marching bands of kids in Harlem playing them. They bolt several buckets to a strip of wood and then strap the contraption over their shoulders.

The problem to be solved in designing any new instrument made up of a collection of pitched percussion elements is how to gather them together in an organized system or structure. This task is complicated by competing criteria for arranging the sounding bodies or notes. The following are my four main design considerations:

1. Ease of use (ergonomics, musical facility, storage and transportation)

2. Structural stability

3. Tonal integrity

4. Visual esthetics

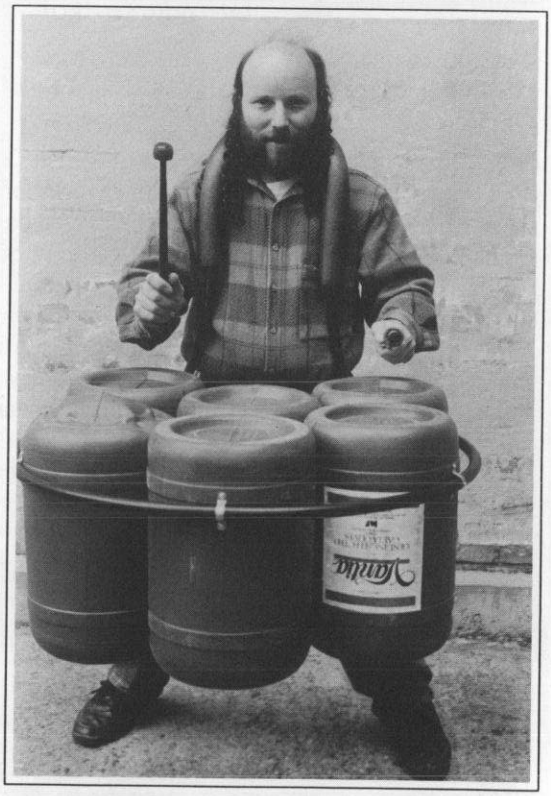
The notes need to be arranged in an order that works musically as well as being physically convenient to play. This usually requires the various elements to stay put when you hit them. Racking and mounting schemes can do a good job of holding things in their places but run the risk of dampening the tone. Vibrating objects sound best unencumbered, and bucket drums are no exception.

Because the Public Works Orchestra travels extensively, I need instruments that are easy to store and transport. A big, clumsy rack is not as space efficient as buckets that nest together neatly. Also handy is the ability to add or eliminate particular notes to meet the musical needs of a given piece. My solution for the Bucket Drum Toms has been to simply turn the buckets bottom up and let each note stand on its own, on carpet or grass.

Cutting large holes in the sides is the simple innovation that makes this possible. Without the holes, upended buckets on the ground or floor sound muffled and dead from the restrictive pressure of the closed space.

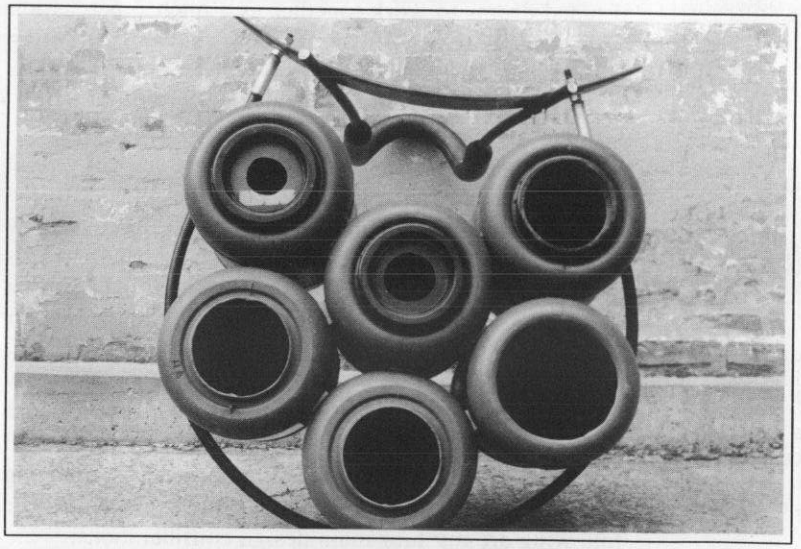
The smaller and higher notes of the Toms are made from containers used for shipping olives; these come fresh from the Park Slope Food Coop with a threaded screw top that I remove. Without any alteration, these olive containers produce a pleasant though more complicated sound, due to the added resonance of the vessel. That is, when you strike the bottom you get two notes—the frequency of the membrane together with the resonant frequency of the contained air.

The uncut olive container, with its narrow opening and smooth sides, is acting as a Helmholtz resonator. This means that when the membrane is struck, that movement excites the contained air, producing its own resonant pitch. The frequency of that resonated pitch depends on the volume of the container and on the size and shape of the hole. (see photos #3 and #4)



Photos #3 and 3A (above and right): Here is a racked Marching Marimba set of olive containers in which I take advantage of the Helmholtz effect by tuning each resonator to a 5th below its own membrane pitch.

Photo #4 (below left): Even though the olive containers all have the same volume of air, larger holes make higher resonating pitches. The membrane pitches from low to high are: B,C#,E,F#,G#,B. The resonators: E,F#,A,B,C#,E.]



For the unracked Bucket Drum Toms, I want to feature the membrane pitch only, with no discernable lower resonating note. I cut off the threaded narrow opening, making a stable base on which the drum can sit, then cut two large holes in the sides just as with the compound buckets.

How large are these large side holes? I make them just big enough to ensure the clarity of the membrane pitch, so that whatever resonance is provided by the perforated container is either diffuse or at frequencies well above the membrane note. In practice the olive containers get 6-inch holes, the compound buckets get 8-inch holes, and the larger bins get 12- to 15-inch holes.

Tuning the membranes at first was accidental: I simply used the pitches that were there. That's fine for a solo instrument, but I like the instruments in my orchestra to play in tune with each other. I discovered that lowering the pitch was easy. A glob of silicone adhesive on the underside of the membrane will add mass and slow the frequency of vibration, thereby lowering the pitch considerably without much change in the tone. Attaching metal washers with the same adhesive adds even more mass and can take the pitch down as far as the interval of a fifth.

Raising the pitch is a bit harder. I thought of how Caribbean steel drums are tuned, and tried softening the membrane with boiling water and distorting the flat bottom upward, giving it a slight curve that remains after cooling. The increased concavity adds rigidity, speeding the frequency of vibration and raising the pitch as much as a minor third. A superior heating medium is the glowing coil of a hot plate, though you run the risk of burning the plastic. See photo # 5. Important: The heated plastics will give off toxic fumes. Work in a well ventilated area and wear a breathing mask.

My Bucket Drum Toms and Marching Marimba are extremely fun to play. You can really whack them. The pitches are not entirely stable — in the hot sun they just go wild, but return to normal after cooling. For both instruments the quality of the tone is remarkably consistent from the lowest to the highest note.

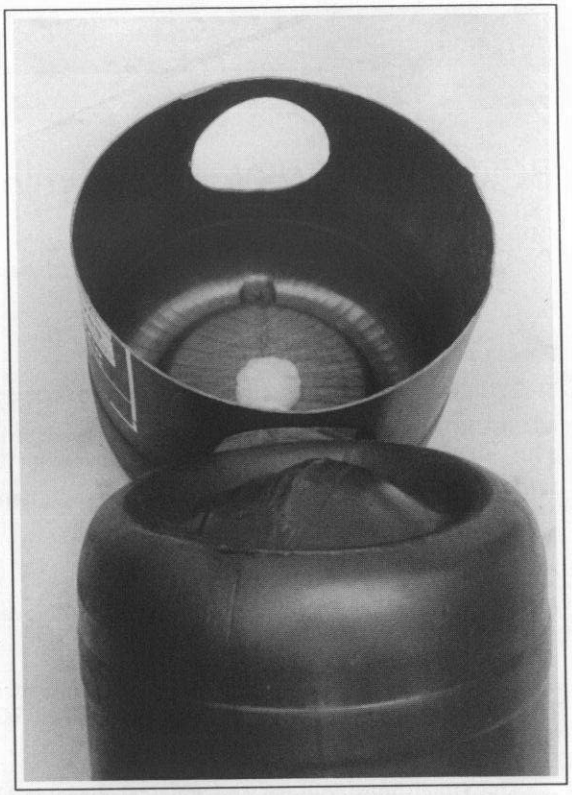
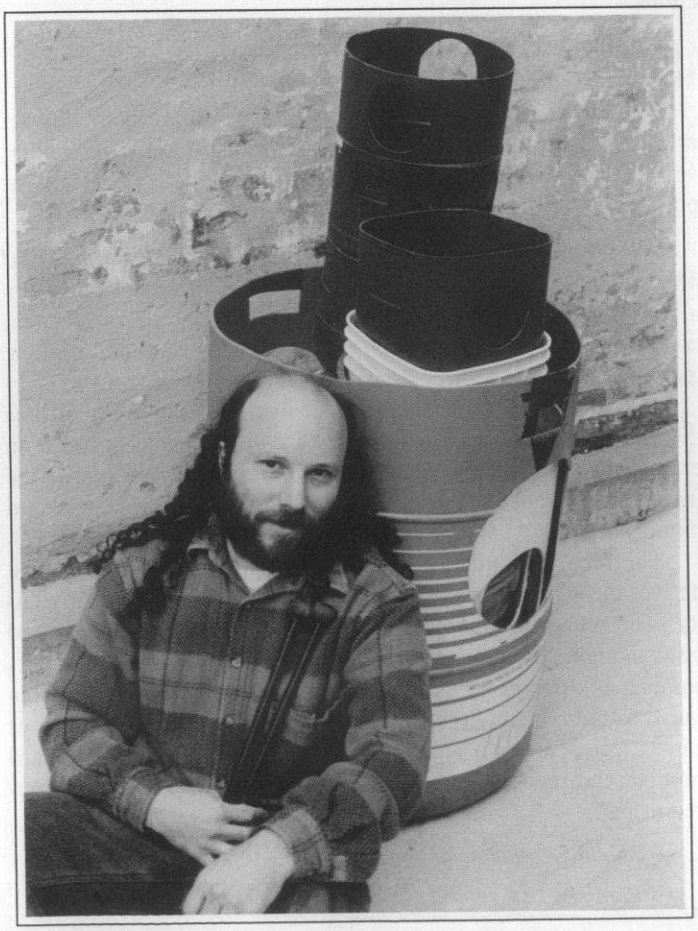


Photo #5 (right). Close-up of my tuning method. Notice the glue on the inside of one buckets' bottom to slow the membranes' vibration and lower the pitch. The other membrane gets its pitch raised by heating and distorting the membrane upwards, thus adding rigidity and increasing the frequency of vibration.

Photo #6 (lower left): All packed up and ready to go in the van.

I fantasize about casting plastic notes in the characteristic shape of the Indonesian bonang, a collection of upside-down metal vessels with a bulging nipple that sticks up from the center of each. The reality is that I enjoy my urban trash aesthetic, turning sows' ears into silk purses. The economics of musical instrument distribution probably won't support my new career in industrial design, but I do think the empty compound bucket has a bright new future. With no cost and few tools anyone could put together a great sounding collection of tuned Bucket Drum Toms.



Jody Kruskal is a composer, performer, vocalist, musical inventor, and educator. He has been building and using hand-made experimental musical instruments since 1984 as the founder and musical director of the Public Works Orchestra, performing dozens of dance and theater commissions including works with Elise Long (Spoke the Hub Dancing) and Ralph Lee (Mettawee River Theater Company). He teaches workshops and residencies at numerous schools, summer camps and arts organizations throughout the eastern U.S. Jody is one of the foremost exponents of the rare anglo concertina, playing contra dances, parties and concerts with the folk bands Grand Picnic, Jaybird and Squeezology. He also composes for and plays with Music for Homemade Instruments and Gamelan Son of Lion.

He can be contacted at 475 Dean St., Brooklyn NY 11217; phone (718) 789-2567.

BOOK REVIEWS (and one related recording review)

By Sasha Bogdanowitsch, Warren Burt and Bart Hopkin

Books by Nelly van Ree Bernard:

THE TUNING MONOCHORD (1991; ISBN 90-73018-41-2)

MONOCHORDIO 'BERMUDO': A hypothetical reconstruction of a 16th century Iberian clavichord and its employment (1994)

THE KEYED MONOCHORD: Rediscovery of a forgotten instrument (1993; ISBN 90-73018-45-5)

Recording by Nelly van Ree Bernard:

REDISCOVERY OF THE KEYED MONOCHORD: Medieval melodies and Sephardic songs (1993; NvRB-62 CD)

All of the above are available from Nelly van Ree Bernard, Muziekcentrum 'Het Duintje', Binnenweg 6, flat 209, 2121 GX BENNEBROEK, The Netherlands. Tel/Fax +31.23-584.6126.

The Dutch musicologist and musical director Nelly van Ree Bernard has for many years specialized in early European music and instruments. (A description of her *citara*, a reconstruction of a medieval psaltery, appeared in *EMI* Volume 12 #2, Dec 1996). One of her special interests has been the monochord, and the possibility of organological connections between the monochord and the later, more sophisticated clavichord. In connection with these topics, she has published several small books and an audio CD, and they are the subjects of this review.

The Tuning Monochord booklet gives the reader a concise but informative account of the instrument's history, description, purposes and employment. Several drawings are included along with a chart that shows a comparison of tunings, from Pythagoras & Aaron to Werckmeister and India, graphically and in cents.

The *Monochordio "Bermudo"* booklet presents an equally informative account of the tuning and clavichord of Juan Bermudo (1555) whose intonation came extremely close to our modern day equal temperament. The author tells the reader of her reconstruction process of this kind of clavichord, illustrated with diagrams of old tunings, a materials list and fretting and tuning schemes, as well as playing styles based on Sancta Maria's playing methods.

The Keyed Monochord by Nelly van Ree Bernard is a well organized book presenting an 'in depth' look on the history, construction and playing of the forgotten instrument, the keyed monochord. Below is an outline of what its eight chapters comprise.

Chapters 1 – 3: "The Monochord;" "Transition from Monochord to Clavichord;" "Keyed Monochords of the 15th Century"

The first chapter offers very similar material to the *Tuning Monochord* publication of above, alongside several quotes from medieval treatises. The second chapter on the transition from monochord to clavichord presents highly interesting material, mainly focusing on how the two possible ways the monochord may have evolved to the clavichord and if these two ways might have developed parallel to each other. The first of these is the evolution from a single-string monochord to a keyed monochord, and the second one is the progression from a monochord with two or more strings to a clavichord counterpart. The third chapter presents detailed descriptions on the workings of the clavichord keys as well as textual and iconographical material on early 15th century singly strung clavichords by Johannes Keck, Conrad von Zabern, and Johannes Gallicus.

Chapter 4: "Hypothetical reconstruction of a keyed monochord"

This chapter outlines the author's goal in "explaining the essence of the clavichord on an instrument of simple construction." Nelly does this by reconstructing an instrument that clearly shows what might have occurred in the transition from the sliding bridge of the monochord to the keys of the keyed monochord.

Chapter 5: "Working, drawing, construction and tuning"

Here, van Ree Bernard gives the reader information on the materials and tuning of the instrument, as well as details on the addition of bourdon tones or drone strings on the keyed monochord.

Chapters 5 – 8: "Experimenting with the Keyed Monochord;" "Playing Methods;" "Musical Examples"

These concluding chapters basically show the author's discoveries in playing methods, the positioning of the instrument either vertically or horizontally, and the playing techniques required for playing the medieval and Sephardic melodies.

All the pieces on the author's CD, *Rediscovery of the Keyed Monochord*, are presented in the liner notes in western notation along with information on the tuning of the bourdon strings, compositional scheme of the piece played, and the playing techniques required for each work.

The disc gives a fair sampling of medieval melodies such as the famous troubadour melody "Reis Glorios," and presents an exciting new look at the performance of Sephardic music with the inclusion of spoken text to the accompaniment of the keyed monochord.

The recording quality and performance are very good and deliver these ancient works and instrument with surprising vitality. The sound of the keyed monochord is probably an acquired taste though. The dry, raw sound rings true and clear, but its sometimes disruptive, chopping playing style is an unavoidable must, as there is only one single melody course and no two keys can be pressed down at any one time. Nelly van Ree Bernard reminds the reader that "a distinct non-legato technique is prerequisite."

— Sasha Bogdanowitsch

HARRY PARTCH: **ENCLOSURE:3**
Compiled and edited by PHILIP BLACKBURN

Innova Publications 402, American Composers Forum, 332 Minnesota St., E-145; St. Paul, MN. 55101, USA. 528 pp. US$75 + $8.50 s/h in USA. Credit card orders to 1-800-388-4487.

Long awaited, this biography/scrapbook of materials by, and relating to Harry Partch is an artistic and publishing triumph. Harry Partch (1901-1974) was, of course, the American composer who spent a lifetime building a unique orchestra of microtonal instruments, writing pieces and theatrical rituals for them, and getting them performed. As if all that weren't enough, this book reveals even further sides of Harry — the writer, the visual artist, the correspondent among them, but not limited even to those.

This book has been a long time coming. Shortly after Partch's death, composer Kenneth Gaburo had expressed the desire to publish Partch's papers in an omnibus volume, and Partch executor Danlee Mitchell had given them to him. Gaburo and his associates worked on the mammoth task on and off for more than 10 years, but his illness and eventual death in 1993 prevented the project from being completed. Philip Blackburn then took up the project, and after several years of detective work tracing sources, getting permissions, raising funds, and working on the layout and organization of the materials, has finally produced a lavish, beautifully laid-out, and massive coffee-table book that will hopefully set a new standard for artistic biographies. I had seen the original materials when Gaburo and Blackburn were working on them, and I couldn't wait to see them published. Now that they are, all my original expectations are wildly surpassed. This is one of the important artistic books of the late 20th century.

Arranged in chronological order, this book gives the sweep of Partch's life, as told in documents, letters, photographs, drawings, scores, essays, reviews, press clippings, etc. Harry was a voluminous letter writer, and reading his correspondence one can share his joys, triumphs, exasperations, and pain. Of special interest to *EMI* readers will be his 1961 "Manual" on the maintenance and performance of his instruments (lots of handy hints for any instrument builder in here!) along with photographs, drawings, and plans for them. The construction of the bass marimba and the marimba eroica (the sub-bass marimba of four tones that plays tones lower than the piano), along with the acoustic research that Partch and his friend, scientist Lawrence Marshall, did in the making of these in the early 1950s is covered in detail, and shows the primitive conditions in which they were forced to do what was basically ground-breaking acoustic research. The photos of Partch sitting under the completed bass marimba, which takes up most of the living room of his Gualala house (which he also mostly built himself!) have an endearing air of triumph to them.

There is plenty of material here for those interested in Partch's theories as well. Partch is well known for his 43-tone just-intonation scale, which is based on relations of the first 11 harmonics of the overtone series. Shown here, though, is the development of his scale, from one that encompasses 29 tones in the 1920s, until it expands to over 50 tones, and then returns to a more manageable 43, although as Partch is at pains to point out many times, he uses many more tones than those 43, which were just a point of reference. The correspondence between himself and John Cage from the 1960s, where Harry threatens to curse John if he mentions the number 43 in connection with his work one more time, hilariously shows the exasperation he felt, even towards sympathetic and supportive colleagues, when they identified him with the number 43. Also of interest here is a fully worked out set of plans for a scale based on the relations of the first 17 harmonics of the harmonic series. Harry never used this in his pieces, but other composers since him, such as Denny Genovese, have.

The multi-medial nature of Partch is very much in evidence too. Drawings and paintings by him, set design plans, sketches, and photographs (his photography is very much influenced by his friend, photographer Edward Weston), all are supplied in liberal amounts. "Bitter Music", Partch's 1935 piece about his homeless wanderings on the West Coast, was originally intended as an "art book", where drawings, music, and text, side by side, would reinforce each other. The drawings were never included in the 1991 edition, so their inclusion here, along with some sample layouts, shows how Partch had originally intended the work to be seen.

Partch's interactions with his many collaborators and acquaintances is also shown here. These range from fruitful and friendly (film-maker Madeline Tourtelot and video producer and artist Bob Kostka) to disastrous and rancorous (choreographers Alwin Nikolais and Martha Graham). I found myself completely absorbed in the book, experiencing a large slab of the artistic life of the 20th century through the eyes of one of its most unique participants. A sense of who Harry was, and how his personality changed through the years, is clearly imparted here. Many of the myths that have grown up around Partch will be disposed of, and a more complete picture of his complexity and seriousness will now take its place. For anyone interested in Partch and his work, this book is more than a great pleasure. It is absolutely essential.

— Warren Burt

KATHY TECK, ROY DOTY AND THE HIT-IT BAND:
BEARS BEAT BOWLS IN THE BATHTUB

32-page book, 16-page activity guide, and audio cassette tape, from Hit-It Kits, PO Box 139, Gedney Station, White Plains, NY 10605.

The great difficulty in making instrument-making books for children is in dreaming up ideas for musical sound-making that are truly simple enough for children to recreate. The tendency for most authors is to get carried away with ideas that are too elaborate, and end up filling the book with things that really aren't guaranteeably kid-buildable. I'm happy to say that in *Bears Beat Bowls in the Bathtub*, a new children's music-making book from Kathy Teck, the sound-making ideas really are simple enough for the littlest ones. This means that not all of the instruments and found-sound objects in *Bears Beat Bowls* have magnificent sound - some of them are a bit klunky - but, then again, many of them do produce satisfying tones and pitch relationships, and even the klunky ones are fun and easy.

The *Bears Beat Bowls* package consists of two books and a cassette tape. The main book is intended for children, with black and white drawings in a cartoony, zoomorphic style, accompanied by easy, large-type text full of rhymes, alliteration, onomatopoeia and catchy rhythm. This book doesn't explain the instruments. Instead, through the text and illustrations, it manages to suggest what they are, how to put them together and how to use them. The second, shorter book is a guide for adults or older children, which gives a few more details, makes the ideas more explicit, and provides further suggestions.

The cassette is a reading of the main book's text, its bouncy lyrics rendered with irresistible good humor by Geoffrey Holder. Interspersed with his readings are recordings of the individual instruments, played by a group of musicians assembled for this project under the name "The Hit-It Band." At the end of the tape is a jam with the Hit-It Band playing all the instruments together. The musicians are skilled percussionists, and the jam really works musically. Great fun.

— Bart Hopkin

J.C. KLEINBAUER:
HOW TO BUILD A BARREL ORGAN: AN ADVENTURE IN PLASTIC

Published by and available from John Kleinbauer, 15 Fisher Place, North Arlington, NJ 07031, phone (201) 991-6659. 87 pages, report-folder-style binding; $29.95.

The semi-automatic musical instrument known as the barrel organ was more common a couple of generations ago than it is today. In its most basic form, a barrel organ is a mechanical wind instrument employing pipes or reeds. The player operates it by turning a crank. The crank drives a bellows to supply the wind. Simultaneously, the crank turns a cylinder (the barrel) with pins or staples protruding from its surface. As the barrel turns, the pins activate a mechanism to open vents that allow the air to reach particular reeds or pipes. By placing the pins in different patterns on the barrel the maker can cause the vents to open in the right sequences to produce melodies. A single organ may use different barrels at different times to provide a repertoire of different tunes.

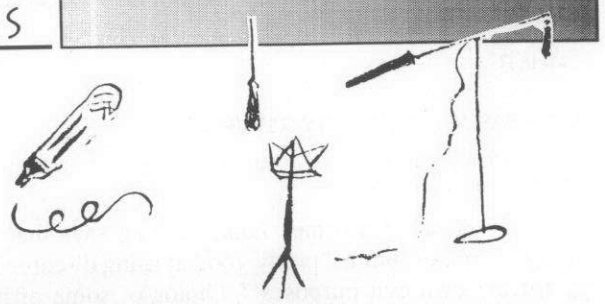
Barrel-organ-like mechanisms appear to have been around since ancient times. They were produced in Europe as early as the start of the 17th century and reached the height of their popularity in the late 19th and early 20th centuries. They appeared in forms both large (often mounted on a wagon or push-cart) and small. They have been associated with mendicant street musicians, but pricey and elegant forms of the instrument have existed as well.

A few years ago, John Kleinbauer, author of the book being reviewed here, became enamored with the barrel organ, its music and its history, and decided to build one himself. He didn't have a lot of previous knowledge of the subject, but he found a good source of information on barrel organ design in the book *Barrel Organ: The Story of the Mechanical Organ and its Repair* by A.W.J.G. Ord-Hume. Unfortunately, the organs that Ord-Hume described called for components now rare or unavailable. What's needed, Kleinbauer decided, is a barrel organ design that can be produced in a home workshop using materials readily available today. He set about creating that design, and the book *How to Build a Barrel Organ* is his description and construction manual for the organ that resulted.

Kleinbauer gives relatively little history or other contextual information. The book is devoted primarily to step-by-step construction procedures. There are no photographs, but the instructions are extensively illustrated with easy-to-read computer-generated diagrams. The organ that Kleinbauer describes is a small, diatonic instrument, with reeds taken from an inexpensive, widely available harmonica. The bellows uses a membrane of canvas coated with silicone rubber, and most of the remaining components are made of the gray PVC plastic. Several pages in the book are devoted to the methods he has found for working PVC, and other sections of the book are devoted to other shop tricks, such as procedures for creating accurate circles and disks (several of which are called for in the mechanisms of the organ). Later in the book, Kleinbauer provides diagrams of barrel pinning layouts for eight familiar old-time melodies. The barrel-pinning diagrams are clear and easy to interpret, making the logic of the pinning patterns readily apparent. This makes it potentially easy for builders to work out pinning patterns for other melodies of their choosing. Although the melodies Kleinbauer diagrams are monophonic, the instrument is potentially polyphonic.

The barrel organ described here is a demanding project — "Just remember Rome was not built in a day!" Kleinbauer warns at the end of the book. In a recent phone call he mentioned to me that as a follow-up to the barrel organ he's now working on an instrument similar in concept but mechanically operated by punched cards — an arrangement which he says will allow him to simplify some aspects of the design and construction process.

— Bart Hopkin



RECORDING REVIEWS

By Warren Burt and René van Peer

ABOMINATION: KEEP THE FREE STATE LITTER FREE

Scott Larson, abomination; John Dierker, tenor saxophone. Cassette (tape 9) from Scott Larson, 318 W. Baltimore St., Baltimore, MD, 21201, or from Widemouth Tapes, Box 382, Baltimore, MD 21203.

The "Abomination" is an assemblage of an electric guitar, electric bass, and drums (plus violin, radio, etc.) put together by Scott Larson, so that he could have the resources of an entire rock band under his personal "one-man band" control. The guitar and bass are usually played by "hammering on" the fingers on the fretboards, while the percussion is mostly played by a series of foot pedals. This results in some wonderfully spread out attacks — when Larson plays the guitar, bass and percussion in rhythmic unison, the basic characteristics of the three instruments, all with different attack characteristics, mean that the instruments are never *really* together. This gives the whole album its delightfully off center feeling. However, not all the polyrhythms here are non-intentional. In some sections, Larson's ability to sustain different rhythms on his three or more sound sources is truly impressive.

The first side of the cassette contains five short solo pieces for Abomination, in which Larson displays virtuosity, imagination and funk. Some of the sounds he draws from his guitar, such as the liquid sound in the middle of track 3, "The police stayed for an hour and a half," and the scratchy texture in track 5, "Plan 9," are just wonderful. His ability to switch timbres and textures rapidly shows off both the potential of the instrument, and his own continually creative musicality. On side 2 of the cassette, he's joined by tenor sax player John Dierker. The mood here progresses from a basic rock beginning through a wide range of styles and references, centering mostly on imaginative extensions of the interplay present between John Coltrane and Elvin Jones in Coltrane's late recordings. In fact, much of this side suggested to me a direction jazz might have gone after Coltrane, if it hadn't retreated into its current mainstream, retro direction. A track like "AM Ascension" is both gentle and complex — Dierker's sax playing makes Larson play a bit more sparsely, and stick with one texture just a little bit longer. The two musicians are clearly engaged here in listening and interplay, even if their musical materials are substantially different. And the sudden transitions Larson makes from, say, percussion to bass is all the more impressive in that it's the product of one person. A most impressive cassette — when are these guys going to make a CD?

—WB

Q.R. GHAZALA: REQUIEM FOR A RADIO

CD (RZD-012) from Realization Recordings, 9452 Telephone Road, #116, Ventura, CA, 93004.

Reed Ghazala's work with circuit-bending is well known to readers of *EMI*. His *Threnody to the New Victims of Hiroshima* CD, previously reviewed here, is an example of his work with these instruments. This CD is something different, though. Part conceptual art project, part fine art collectors edition, and part *musique concrete* composition, it is a documentation of the compositional, visual and physical residue left by a process — that of Reed prying apart a small plastic transistor radio, grinding it up in an ice crusher, melting the results, and then sawing them into chunks. The liner notes document the results of the process with beautiful black and white and color photos, and included in the first 250 copies of the CD is a laminated collector's signed and numbered trading card which encloses a tiny chunk of the actual radio.

Musically, from the description of the process, I was expecting something much more violent that what I heard. But Reed is here making a requiem, and his activities involve not just destruction, but mourning for that destruction as well. In addition, the heritage of *musique concrete* — where one is attempting to abstract the musical qualities of the real world sound one is using, placing the narrative qualities of the sounds clearly in second place — is also active here. Like *Threnody* this is slowly progressing, almost stately music. The sonic nature of each of the four movements is informed by the sounds produced in that phase of the destruction — crackling mechanical sounds for the initial prying apart, chord-like sounds based on the motor of the ice crusher for the grinding, low gray swooshing sounds for the melting, and polyrhythmic loops based on the different rhythms of the sawing — but the overall structures of the movements are more determined by Ghazala's compositional desires than by any attempt to depict, in a documentary way, his destructive processes.

The first movement is a slow arch, which gradually adds more and more layers of texture of the grinding, crackling, snapping sounds involved in reducing the radio to a pile of rubble, before taking them away and allowing a long dying away. The second movement relies heavily on loop machines and short delays to extend and abstract the sounds of the grinder. Even when I could clearly recognize the grinding sound of some part or other being pulverized, the way Reed handled them seemed to reduce the impact of the violence involved in making the sound — allowing us to hear the quality, the texture of the sound first. The third movement is a quieter, more textured movement. Again, some sounds of burning (sounding like a blowtorch) are recognizable, but the overall impression is one of an abstract texture of mechanically produced sounds. The final movement is again dominated by loops and rhythms, this time due to the rhythmic nature of the final deconstructive activity — sawing. Some of the polyrhythmic textures here are quite delicious.

This album is quite noisy, but curiously, never aggressively so. It's also one of the few albums that I would unreservedly use the term "industrial" for — here Reed is using the actual sounds of his destructive mechanical activities as the basis for making

music that is simultaneously celebratory, observational and mournful.

— WB

HARD HEARING 10: **GRAVITY REVERSED**

Cassette (hard hearing 10) from James Boring, 031 SW Caruthers #D, Portland, Oregon, 97201.

Composer and performer James Boring says that he is not really an inventor, but is "pretty good at using discarded technology for my own evil purposes." Photos of some of his reconstructed musical instruments, including a cassette recorder with a displaced playback head allowing extreme real-time pitch bending, appeared in *EMI*, Vol 12, #3. That machine is used on this tape on two of the tracks, "Caffeine Shuffle" and "Gravity Reversed." This machine, combined with long delays, allows him to assemble evolving sound textures which use a wide variety of sounds, and yet still retain a repetitive rhythmic feel. The first side of the tape, a solo side, is in fact subtitled "music for dance" and would indeed be most appropriate for dancing of either the social or the choreographic kind. It's not dooff music however (as in dooff-dooff-dooff-dooff), but music that keeps changing its focus, and its energy, while still maintaining an overall sense of a regular beat. Some of the beats are quite abstracted, in fact. In some parts of "Caffeine Shuffle", there is an unmistakable feeling of 3/4 waltz time, despite the intricate textures mixed above and around the basic feel. As in Boring's previous work, *A Nat Hema*, there is a humorous looking at the fears of popular media culture. Side one ends with two words played backwards, which sound like "heaven devil," and side two ends with a fragmented copy of someone's answering machine tapes. Side two features additional musicians: Fred Chalenor on bass and golf club cocktail strainer, and one track, "2nd Fiddle" the most rock-like track, adds Mr. Pharmacist on drums and Timothy Scarrott on a second bass. The title track from side two also uses the cassette speed change machine, and some analog synthesizers, for the most "electronic" sounding track on the album. And "I hear your potato," the final track, is hilarious in its use of what I hear as "pseudo-ethnic" riffs as it builds up a complex texture over it's repeating loops. I enjoyed Boring's previous tape, *A Nat Hema*, quite a bit. I enjoyed this one even more. Clearly, he's a developing talent whose work will be worth following.

—WB

FRANCISCO LOPEZ & KLAUS SCHUWERK: **TONHAUS**

Booklet with CD, co-produced by Asellus and Hyades Arts: Asellus, Apartado 2542, 28080 Madrid, Spain; Hyades Arts, Apartado 39032, 28080 Madrid, Spain.

The marine world is an important source of inspiration for the sound works of the Spanish composer Francisco López. He seems to look away from the vast expanses, the titanic forces going around in seas and oceans, its impressive life forms. Rather he concentrates on minuscule organisms, crustaceans — or even on the zones where life as we comprehend it does not exist. Perhaps these are the most fascinating regions. What goes on there escapes extrapolation from what we know. López' collaborative CD Azoic Zone was based on possible translations of what these domains are like into sound. It consisted for a large part of processed white noise.

Tonhaus takes this a step further musically, but is quite different in concept. It is a joint project of López and Klaus Schuwerk. As the title suggests ("Tonhaus" means "sound building" in German), it is conceived as a symbiosis of music and architecture, though not in the sense that the two have been designed to fit together. The idea is to have two autonomous entities, separate from each other to the extent that they are complementary in the senses that they address. Brought together they should form one integrated whole, in which the sound determines one's perception of the building and vice versa. According to the text in the booklet this building is located northwest of Madrid in a mountain forest on the Eresma river. I have my doubts whether it was indeed constructed, but listening to the CD whilst reading the texts and looking at the drawings and diagrams stimulates the imagination, evokes a feeling of how it must be to wander around in that environment.

López writes that in the compositions he tries to express his current concept of minimalism in music, "which I think is extremely distant from its common use in music, but quite close to its application in some sculpture and painting. I refer to those conceptions that appreciate the immense beauty of simplistic and compact forms with an inner universe of hidden content" Later on he relates broad-band or white noise with white painting, "I (...) believe in the latent non-neutrality of these materials and in the existence of an aesthetic world to explore through them." What is particularly interesting about his view is that it seems to be analogous to the way the Kaluli of Papua New Guinea compose their songs in close correspondence with waterfalls. The music emerges out of the broad-band noise, as if it had been waiting there to be plucked ever since the first water gushed forth. Something like that also happens on this CD.

There is more, though. López breaks the neutrality by the titles of the pieces. These hint at zoology, history (real or apocryphal), mythology — thus suggesting a universe of the imagination, a world that may or may not coincide with the one we live in. On another level these sounds were composed as an environment, and yet they are far removed from soundscapes; there is no apparent connection with electronic or electro-acoustic music, either. The penultimate track *La batalla* (the battle) which constitutes the middle section of a piece called *The clash of ctenophores from two oceans* is a deep hum of fluctuating density that lasts for twenty minutes. I hesitate to call it music. It is more a sonic presence, as if some sort of entity makes itself known through a barely perceptible pressure. Francisco López has managed to create a niche for himself that, to my knowledge, is unique. One can only wonder what his next step will be — I mean, how much further can one go on this road to reduction.

— RvP

MIYA MASAOKA, TOM NUNN AND GINO ROBAIR: **CREPUSCULAR MUSIC**

CD BRD 030 from Rastascan Records, PO Box 3073, San Leandro, CA. 94578-3073.

At the end of a hot new years day in Melbourne, I put on this CD. Dusk was just setting in. The sounds of Miya Masaoka on koto, played in many different ways, Tom Nunn on his homemade instruments, and Gino Robair on percussion filled the room with their gentle, almost romantic, interactions. It fitted the hot end-of-the-day mood perfectly. A look at the liner notes revealed that the music was recorded live in San Francisco on July 8, 1995 — also in the middle of summer. Maybe just a coincidence, maybe not, but regardless of the weather you listen to this album in, pleasure will surely be yours. Comprising one uninterrupted

46-minute session, the music ranges from non-rhythmic and textural to gently sustained, and at times, almost melancholy or impressionistic. Other sections are more propulsive and complex, but the basic feeling of a sustained mood is a striking feature of the CD. Masaoka plays koto in a variety of ways — traditional plucking, hitting the strings with sticks, bowing them, etc., and Nunn is similarly wide ranging in the number of techniques he applies to his instruments. His ability to sensitively blend in with almost any other collaborator is clearly shown here in one section where Masaoka is plucking out a repeated chord on the koto, and he begins to (I think!) scrape a comb along a threaded metal rod. The sound not only matches the texture of what Masaoka is doing, it matches her pitches as well, to the extent that she can then stop playing the pitches contained in the threaded rod, and concentrate on the lower parts of the chord. All three players, in fact, use such a variety of sound making techniques, that the album is less like a trio improvisation, and more like a playing by many hands on one big multi-timbral super instrument. An album well worth hearing, not only for the virtuosic sensitivity and interaction of its participants, but also for the sheer sensuosity of its sound as well.

—WB

JOHN HERRON: **THE MAGNETIC FIELDS**

On cassette from John Herron, 544 East 3635 So., Salt Lake City, UT 84106

VARIOUS MUSICIANS: **ARRYTHMIA 3**

On CD from Charnel Music, PO Box 170277, San Francisco, CA 94117-0277. CHCD-20

According to percussionist John Herron his cassette *The Magnetic Fields* is a sort of Best of... compilation of the hits he scored. He hopes the music will put the listener in a Romantic mood, will bring a tear to the eye, will bring back memories. With all the callous that has grown on my soul over the years I am afraid it didn't quite work that way for me. The music on this tape may have such effect on others, though. Part of this music is moody, atmospheric. So much so that at one point an "interstellar shuttle cabin attendant" is summoned for guidance. Especially on side A some pieces lean towards rock, with sax and heroic guitar. One track is an excursion into backward and forward percussion laid out on top of each other and Incantor (yes, Reed Ghazala's device) distorted hum-and-buzz mixed in for good measure. In another, Gothic deep chords come oozing from synths, backed up no end by dramatic hits on timpani, then almost topple headlong into a Goldfinger theme riff — only managing to keep upright at the very last moment. On side B Herron forgets about electric guitars, does away with most of the keyboards, departs from reverb and spaceyness; and launches himself into longer pieces in which he utilizes sound effects on drums and an array of "allsorts, and lots more poop." Things sound a bit more focused there. *The Magnetic Fields* is not an even admixture throughout.

Herron is also featured on *Arrhythmia 3*, a collection of percussion oriented pieces by a variety of musicians and groups. Most of this is Gothic stuff, with more than a suggestion of trance and ritual. Strange, isn't it, that with technological progress occurring at a desperate pace, people seem bent on using it to attain (or pretend) a state of mind associated with cultures that have no machine technology to speak of. One problem I have with this music is that it's often heavy and rather (and this may be a very uncool thing to say) pompous and grim. Not much lightness within earshot. In fact Herron's piece *Mantra* is one of the lighter tracks of this album. No pretense of spiritualism here. No macabre ooh-ing and aah-ing choruses. With washes of processed fragments rolling over, this is percussion predominantly, repetitive and hypnotic. And quite pleasurable at that.

— RvP

LIFE GARDEN: **SEED**

CD (recorded in 1993) from Agni Music. Life Garden, PO Box 1928, Phoenix, AZ 85001-1928

VOICE OF EYE AND LIFE GARDEN:
THE HUNGRY VOID — VOLUME ONE: FIRE

CD (recorded in 1994) Void 001 from Agni Music, PO Box 1928, Phoenix, AZ 85001-1928, or from Cyclotron Industries, PO Box 66291, Houston, TX 77266.

Life Garden is a group from Phoenix consisting of Bill Yanok, Peter Ragan, David Oliphant, and Su Ling Heydrich-Oliphant. They who make long, dreamy, meditative pieces with a variety of acoustic and homemade instruments, where each player modifies their own sound using multi-effects units and delays. Most of the music is made with group improvisation which is then recombined and mixed with other improvisations resulting in a rich, multilayered feeling.

Seed, the first of two CDs from them reviewed here, is made up of a number of tracks of improvisations with a "world music" sound, processed and mixed into a sonic journey. At its worst, I was reminded of someone's memory of a childhood spent listening to Folkways non-Western recordings, but these moments were brief. Mostly, the result is alluring. Track 2 on *Seed*, for example, features a very nice electronic processing of Sho (Japanese mouth organ) sounds, that somehow did seem a fitting realization of its Sanskrit title "Parinuta (praised, celebrated)." Track 14, "Karnadhvanana (singing in the ear)" is a beautiful piece with flute, voice and reverb which also seemed to convey the aptness of the title. Mostly textural, rather than melodic, one of the appealing things about the album is the way it was mixed. If two vocal or instrumental lines harmonically clashed (that is, the juxtaposition didn't conform to Western pop harmonies), this clash was left in. These moments of harmonic disagreement of what was basically modal singing and playing were delicious, and kept me listening.

Percussive and textural playing dominate, so much so that except for the ubiquitous singing voices, the repeated plucking on sitar on track 11 seemed like the first clearly articulated melodic playing on the album. It wasn't, but its striking nature gave that impression. The work is composed of separate tracks, but the overall impression is of one coherent piece that seamlessly flows through time.

This is even more the case with *Fire*, a collaborative CD made with the Houston duo Voice of Eye (Bonnie McNairn and Jim Wilson). Here, the 9 tracks melt into each other in one of the most subtle and beautifully controlled mixes I've heard in quite a while. Again, the mixing is nicely polytonal and polytextural, but even more fragile and contained than in *Seed*. Processing here is even more predominant. At one point, I found myself thinking, quite irreverently, that the piece was a solo for reverb unit with instrumental accompaniments. It was the subtlety of the mixing that gave me this impression. Everything is evanescent, just barely stated, and then submerging back into the sea of reverberation from whence it came. Only rarely does a specific texture, such as the percussion playing in track 2, emerge, and when it does, it seems more like a memory than a statement existing in the present. Often instrumental sounds are transformed into a series of chords

and textures with long attacks and decays, with soft ornamentations flittering in and out. Only near the end, in the 8th and 9th tracks, do the mists seem to lift, with some modal playing on flute and percussion. The texture of flute, what sound like brass chords, and a low bass throbbing in the last track is delicious indeed. Both CDs have much to offer the listener, but the sense of disciplined overall structure seems much stronger in *Fire*. Apparently, the collaboration of these groups has produced enough material for several albums, and I'll look forward to hearing the others.

—WB

RICK HEIZMAN: HARD TO REACH PLACES

On CD from EarthView Music, EV 07-2. 1440 15th Avenue, San Francisco, CA 94122.

UZBEKISTAN — TURGUN ALIMATOV

On CD from Ocora, C 560068

MUSIC IN THE WORLD OF ISALM 1 — HUMAN VOICE/LUTES

On CD from Topic Records, TSCD901

Rick Heizman calls himself an 'all world' musician, absorbing music and culture on his travels. He has collected instruments from places where he visited. "As I study and explore a new instrument I try to find its heart and soul — then I feel I can freely and honorably use it in a traditional, innovative, or an unexpected way." With these instruments and experiences he creates a music that exudes an oriental aroma but remains firmly rooted in Western conventions and aesthetics. I will readily believe that he finds himself challenged by unfamiliar cultures and their instruments, that he finds himself challenged by trying to learn to play these instruments, that he finds himself challenged to create his own music out of this. But then he must also have thought that his main challenge was not to challenge the listener too much.

Maybe he has indeed found the heart and soul of the dutar (a two-stringed Central Asian lute), but the best expression of its voice still comes from musicians who are part of the tradition from which the instrument has sprung. The Uzbek dutar player Turgun Alimatov really takes you to a breathtaking depth, where only the nearly eclipsed resonance of a single note is all that stands between your ears and nothingness. On the first CD in the three part *Music in the World of Islam* series ud player Sultan Hamid from Bahrain draws fire from his instrument making flamenco guitarists sound phlegmatic in comparison. Heizman is a skilful musician, but smoothing over the gritty, jagged and craggy elements that make the music from many non-Western cultures so acutely alive, he demonstrates that if he has indeed absorbed them — he has not taken them in.

By the way, the entire *Music in the World of Islam* series is worth sounding out. It is a re-issue on CD of six LP albums from the mid-1970s. #1 covers voices and lutes, #2 strings (that is, fiddles and qanuns), flutes and trumpets, #3 reeds & bagpipes, drums & rhythms. The Muslim areas then under communist rule are underrepresented for obvious reasons. Still, covering ground from Morocco as far south as Nigeria and Uganda, and as far east as Malaysia and Indonesia, the recordings demonstrate the staggering diversity of cultures united under Islam.

— RvP

NOTICES

Stockholm, Hey Listen! is an international conference on acoustic ecology organized by the Royal Swedish Academy of Music in partnership with the World Forum for Acoustic Ecology, set to take place June 9-14, 1998 in Stockholm, Sweden. The conference will focus on the use and abuse of sounds, the design of artificial sound, and the theme "From Awareness to Action." All conference proceedings will be in English. For more information, email h.karlsson@musakad.se, or on the web visit http://interact.uoregon.edu/MediaLit/FC/WFAEsc.html. [13-2]

The 1998 meeting of the International Symposium on Musical Acoustics will be held June 26 - July 1 in the Cascade Mountains outside of Seattle, Washington, jointly sponsored by the Catgut Acoustical Society and the Acoustical Society of America. For more information visit the ISMA Home Page at http://www.boystown.org/isma98/ or fax (201) 744-4029. [13-2]

RESEARCHING "ONE MAN BANDS." Mandolinist/journalist Niles Hokkanen is researching the subject of "one man bands" and musicians who perform on 2 or more instruments simultaneously. Niles would like to talk to these types of musicians about their setups, how they solved physical multi-instrumental dilemmas, why they began performing multiple musical functions, and the mental learning processes involved. Photos, recordings (commercial or cassette demos), etc. can be sent to Niles Hokkanen, PO Box 3585, Winchester, VA 22604; phone (540) 722-9429; email mandoman@monumental.com (Niles who is a notable mandolinist, also plays midi-bass pedals and foot percussion/drum-kit and has constructed portions of his own gear.) [13-2]

The World Shakuhachi Festival 1998 is will take place July 5 – July 10, 1998 at the College of Music, University of Colorado, in Boulder. For information, contact Christopher Yohmei Blasdel, email kokopelli@inJapan.net; or Monty Levenson, Tei Hei Shakuhachi, PO Box 294, Willits CA 95490 USA, email monty@pacific.net; web site http://www.pacific.net/~shakuhachi. [13-2]

FOR SALE: Deagan Organ Chimes in excellent and playable condition. For further details: phone 64-21-480.115; mail PO Box 6070, Brookfield, Tauranga, New Zealand; email greenslade@xtra.co.nz.

FOR SALE: Music cassettes of beautiful relaxing New Zealand music, featuring the Deagan Organ Chimes. Innovatinve and original compositions, 1 hour, vocal and instrumental, 2 titles "Wild Rose" and "Hand Knitted". Written and produced by Gypsy Pennefeather. $10 each plus freight. Phone 64-21-480.115; mail PO Box 6070, Brookfield, Tauranga, New Zealand; email greenslade@xtra.co.nz.

Bears Beat Bowls in the Bathtub, a new book/tape/guide set for children by Kathy Teck, illus. Roy Doty. Narrated by Geoffrey Holder; original music by the Hit-It Band using homemade instruments. $19.95 plus $2.84 shipping (NYS residents add sales tax). Hit-It-Kits, PO Box 139 Gedney Station, White Plains NY 10605.[13-1]

THE TACTUS PRESS. Theremin and historic percussion publications. Write for catalog: The Tactus Press, Dept. EX, PO Box 9704, Austin, TX 78766-9704. (512) 453-7779; email bobs@ccsi.com.[13-1]

Seeking information: If you have information about bamboo saxes, or other sorts of unusual sax-like instruments, builders, history, references, anywhere in the world, please contact Ángel Sampedro del Río, Scalabrini Ortiz 1960, Villa Adelina (1607), Buenos Aires, Argentina, fax [international code, plus] 541-794-3880.[13-1]

Bamboo Stamping Drums from the traditional bamboo for this purpose -- Schiziostachyum glaucifolium -- light, straight, thin wall, strong. 3 sizes. Comes in pairs. sml 18-24 in. = $35. med. 2-3 ft = $50. large = $90. Smoked and oiled and bound. Comes with pads and information. pack and ship air/priority in U.S.=+15%. Richard Waters, PO Box 1071, Pahoa, HI 96778.[13-1]

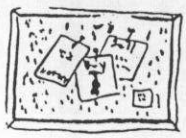
EXPERIMENTAL AND ELECTROACOUSTIC RECORDINGS FOR SALE. Many unusual titles, such as Harry Bertoia, etc. LPs a specialty. Send for free listing to: SONIC TIGER MUSIC, PO Box 715, Cambridge, MA 02140 USA; email stmusic@shore.net. [13-1]

Information wanted about the horned violins made in Burma, or if anyone traveling to Burma would like to help with some research for a future *EMI* article, please contact: Cary Clements, 1197 South Van Ness Ave., San Francisco CA 94110; phone (415) 206-9531; e-mail stroviol@earthlink.net.[12-4]

ORDER THE MUSIC OF THE GRAVIKORD, Bob Grawi's electric double harp based on the African Kora (featured in EMI, April 1988, and Bart Hopkin's new book *Gravikords, Whirlies and Pyrophones*). Cassette tapes $10; CDs $15 (+1.50 s&h) to White Bear Enterprises, PO Box 106, Florida NY 10921; 914/651-2327.[12-3]

Earthshaking Music '97 "World Music Source" is now available (Free!). 400+ cds, books, videos & cassettes. Instruments from everywhere! Submissions of research papers, videos, recordings, instruments, etc welcomed for inclusion in our catalog. Email to erthshkn@avana.net or call (404)622-0707. [12-3]

Reed Ghazala's **Anti-Theory Workshop** is now offering circuit-bent Incantors, Trigons, Photon Clarinets, Morphiums, Aleatrons, one-of-a-kinds, CDs and collected writings. For Reed's full-color, visually stunning brochure/catalog/fractal artwork depicting 18 instruments, CDs, friendly raccoons and more, please send $1 (or any interesting tidbit of your choice) to: Reed Ghazala c/o **The Anti-Theory Workshop**, Sound Theater, 3325 South Woodmont Ave. Cinti., OH 45213. Present web: http://www.iac.net:80/~cage/reed.html. Coming soon: http://www.anti-theory.com E-mail: qrg@anti-theory.com [12-3]



GRAVIKORDS, WHIRLIES AND PYROPHONES -- book-and-CD boxed set from *Experimental Musical Instruments*, produced in conjunction with the publishing company Ellipsis Arts. A book-and-CD combination devoted to new and unusual musical instruments from some of the world's most interesting and inventive instrument makers. Informative text, wonderful photographs and great recordings. Every track of the CD and page of the book overflow with the ideas and the originality of the featured builders. 37 musical instrument makers appear in the book, with music from 18 of them included in the CD. Price $29.95 for the book and CD (no shipping charges for U.S. air mail or overseas surface rate; add 25% for overseas air; California residents only at 7.25% sales tax), available from EMI at PO Box 784, Nicasio, CA 94946, USA; phone/fax (415) 662-2182; e-mail EMI@windworld.com Visa & Mastercard accepted. [12-3]

Musical Instrument Design: Information for Instrument Making, by Bart Hopkin, editor of *Experimental Musical Instruments*, published by See Sharp Press. *Musical Instrument Design* presents underlying principles for the design and construction of acoustic musical instruments of all sorts, with a practical, hands-on approach. No other book gathers this information under one cover. Just under 200 pages long; large format; fully illustrated. $18.95 plus $2 s&h. (This covers shipping charges for U.S. air mail or overseas surface rate; for overseas air add another 25%. Customers in California add 7.25% sales tax.). Order from *Experimental Musical Instruments*, PO Box 784, Nicasio, CA 94946, USA, phone/fax (415) 662-2182. [11-4]

The EMI Wall Chart is a beautiful 24"w x 36"h wall poster, with graphic design by Gwendolyn Jones, covered with practical reference information relating to musical instruments and instrument making. Suitable for the workshop or living room. Some of the material on the chart replicates material in the *Musical Instrument Design* book (see previous ad), but since the wall chart format has its own advantages, you might be happy to have both. The price is $12. (No shipping charges for air mail within the U.S. or surface rate overseas; for overseas air add 25%. Customers in California add 7.25% sales tax.) Order through *Experimental Musical Instruments*. [11-4]

Making Simple Musical Instruments: A Melodious Collection of Strings, Winds, Drums & More — A book by Bart Hopkin, editor of *Experimental Musical Instruments*, published by Lark Books. It is a collection of plans for home-buildable musical instruments, ranging in difficulty from simple to moderate. The book is written for a general, non-specialist audience, and the approach is non-technical. The instruments aren't so very far out: most of them relate to familiar instrument types and are playable as such. Yet even experienced experimenters will find some new ideas here. It's hardbound, with 144 big and very full

pages, lots of color, beautiful photos & illustrations; price $24.95 plus $2 s&h. (This covers air mail within the U.S. or overseas surface rate; for overseas air add 25%. Customers in California add 7.25% sales tax.) Order from EMI, PO Box 784, Nicasio, CA 94946, USA, phone (415) 662-2182; email EMI@windworld.com. Visa/MC accepted.

Air Columns and Toneholes: Principles of Wind Instrument Design is a spiral-bound booklet containing the four articles on practical wind instrument acoustics by Bart Hopkin that appeared in EMI in 1992 and 1993. The articles have been revised and improved, and there are several additional features included. Published by Tai Hei Shakuhachi; available for $14.00. (This covers air mail shipping within the U.S. or surface rate overseas; for overseas air add 25%. Customers in California add 7.25% sales tax). Order from EMI, Box 784, Nicasio, CA 94946. Visa/MC ok.

SUBSCRIPTIONS TO EMI: $24/yr for U.S.; $27/yr for Canada & Mexico; $34/yr overseas. Order from EMI, Box 784, Nicasio, CA 94946, USA. Visa/MC accepted.

EMI BACK ISSUES: Bound volume sets Vol 1 through Vol. 12: $17 per volume. Each volume set contains all of the issues of one volume year, photocopied and bound under one cover. The photocopies are a step down in quality from the original press runs, but they are decent as photocopies go, and they are fully readable. Individual back issues from Volume 13 and later are available in the original press run at $6 each. These prices cover air mail shipping within the U.S. or surface rate overseas; for overseas air add 25%. Customers in California add 7.25% sales tax. Visa and MasterCard accepted. Order from EMI, PO Box 784, Nicasio, CA 94946, phone/fax (415)662-2182, email emi@windworld.com, or write for a listing of back issues and their contents. Corresponding cassette tapes are available for later volumes; see information below.

CASSETTE TAPES FROM EMI: Each cassette in the EMI cassette series contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, funny and beautiful music. Volumes 6, 8, 9, 10 11 and 12 are available. (Vols 1 - 5 and 7 are now sold out). The price is $8 per cassette. No additional shipping charge for air delivery in the U.S. or surface delivery overseas. For overseas air add 25%; in California add 7.25% sales tax. Order from EMI, Box 784, Nicasio, CA 94946. Visa & MC accepted.

RECENT ARTICLES, continued from back page

"Scale Length and Tone," by Ralph Novak: a discussion of the relationship between string length and tone quality in guitars;

"The Design and Construction of an Eccentric Guitar," by Kevin B. Reilly: a description of an unusual double-neck guitar;

"Rocky Mountain Tonewood Alternatives," by Don Musser: a report on soundboard woods growing in the Rockies;

"Prepare to Meet the Maker: Boaz Elkayam," by Jonathan Peterson: an interview with the maker of some highly unusual guitars (odd shapes, multiple fret boards, beautiful decorative work), with lots of photos;

"Of Sympitars and Suzalynes," by Fred Carlson: Fred Carlson discusses his unique guitar-like instruments, as well as the equally unique violin-like instruments made by Suzy Norris. Both involve curvilinear, asymetric shapes and sophisiticated arrangements of sympathetic strings.

And in *American Lutherie* No. 52, Winter 1997 (address given above): the usual wealth of articles on guitars and other string instruments, including "The 1997 Healdsburg Guitar Festival" by Jonathan Peterson et al, replete with lots of photos of beautiful, unusual and innovative guitars.

The following is a list of selected articles relating to musical instruments which have appeared recently in other publications.

"The Panpipe Tradition of the Solomon Islands" by Stan Ford, in *Kalinda*, Fall 1997 (Center for Black Music Research, Columbia College, 600 S. Michigan Ave., Chicago, IL 60605-1996).

A wide-ranging report on the bamboo stamping tube and panpipe ensembles in the Solomon Islands, including information on the instruments themselves, the musical form, and the surrounding society.

"Booming Sand" by Franco Nori, Paul Sholtz and Michael Bretz, in *Scientific American*, September 1997.

An attempt to explain the physical causes of the unusual sounds from sand heard at certain beaches in diverse parts of the world and described variously as booming, singing, whistling or squeaking.

"Played by my Instruments" by Johannes Bergmark, in *Rubberneck 26* (c/o 21 Denham Drive, Basingstoke, Hampshire, RG22 6LT, England).

Johannes Bergmark, maker of one-of-a-kind instruments often characterized by unusual and inventive modes of interaction between the player and the instrument, describes several of them in this article, and, along the way, imparts some of his philosophy.

"A Century of String Making" and "Strings ... The Unsung Heroes" (no authors credited) in *Harp Today*, Fall 1997 (Lyon & Healy Publications, 168 North Ogden Ave., Chicago, IL 60607).

Two articles on harps strings — one primarily historical; the other primarily physical and practical.

"Maple vs. Birch: Which Goes Best with your Grain?" by Mackenzie Kerr, in *Stick It*, premier issue, January 1998 (3645 Jeannine Dr. Suite 201, Colorado Springs, CO 80917).

A discussion of different types of and materials for drum shells.

"Percussions de la Réunion" by Jean-Michel Hugly, in *Percussions* No. 52, July-August 1997(18, rue Théodore-Rousseau, F-77930 Chailly-en-Bierre, France).

A discussion of percussion instruments from the island of Réunion in the Indian Ocean (in French).

"The Shaping of Oboe Reeds: Maybe It Is Rocket Science" by Malcolm E. Brown in *The New York Times*, Oct 21, 1997.

A report on an attempt by the husband of an oboe player to create scientific models for making the best possible oboe reeds, in hopes of bringing reproducible results to the hit-or-miss business of reed making. Details of the models are not discussed.

"In this Corner" by Matthew James Redsell, in *Continuo* Vol. 21 #4, Oct 1997 (PO Box 327, Hammondsport, NY 14840).

The publisher of *Continuo*, in his regular column, discusses reproductions of a couple of interesting early keyboards instruments, including a chromatic harpsichord with a special keyboard to accommodate more than twelve tones per octave.

"Martin Covers More Price Points" and "Guild's New Lease on Life" (no authors credited) in *The Music Trades*, July 1997 (80 West Street, PO Box 432, Englewood, NJ 07631).

Two articles on guitar manufacturing and marketing, each with several factory-floor photos of production methods.

Newsletter of the American Musical Instrument Society, Vol 26 #3, October 1997, (4023 Lucerne Dr., Huntsville, AL 35802) has several articles of interest:

"Musée de la Musique: A Museum in the Cité" contains information on the grand new musical instrument museum in Paris' Cité de la Musique, adapted from Marie-Franc Calas' text in *Musée de la Musique: Handbook*.

"Why Repatriate Musical Instruments" by Franc Menusan of the American Indian Ritual Repatriation Foundation is both a plea and a reasoned argument urging museums and collectors to respect the traditions from which collected instruments come, and requesting the return of instruments that may have ritual significance.

"Selected Web Sites Concerning Musical Instruments," by Albert Rice, is a listing of sites primarily oriented toward historical and western instruments.

"Articles About Musical Instruments Published 1995-1996" by Carolyn Bryant is a five-page listing, once again oriented primarily toward standard or historical instruments.

Journal of the American Musical Instrument Society 1997 (address given above) contains extensive articles on koto, early brass instruments, and early English pianos, along with book reviews and a list (more extensive than that mentioned above the *AMIS* Newsletter) of recent publications concerning musical instruments.

Leonardo Music Journal #7, 1997 (MIT Press, Five Cambridge Center, Cambridge, MA 02142) contains a wealth of articles on innovative concepts in music making, most of them in this issue oriented toward digital technology.

CAS Journal Vol. 3, No. 4 (Series II) (112 Essex Ave., Montclair, NJ 07042-4121) contains the following:

"The Violin Octet: Its First Forty Years," by Paul R Laird — a report on the acoustically resigned new violin family;

"Strings and Metallurgy," by Norman C. Pickering — a discussion of the processes by which metal strings are made and aspects of their acoustics;

... plus several more articles on various facets of violin acoustics.

Musicworks #69, Dec 1997 (179 Richmond Street West, Toronto, Ontario, Canada M5V 1V3) contains multiple articles focussing on two pioneers of electronic music: Martin Bartlett and David Tudor.

Also in *MW* 69: "Antarctica: Austral Soundscapes," by Douglas Quin — a sound recordist's journal from a trip to Antarctica, full of descriptions of the region's extraordinary soundscape.

American Lutherie No. 51, Fall 1997 (8222 South Park Ave., Tacoma, WA 98408-5226) contains several noteworthy articles, including —

(Continued on page 47)